FEBRUARY 13, 1937

ELECTRICAL WORLD

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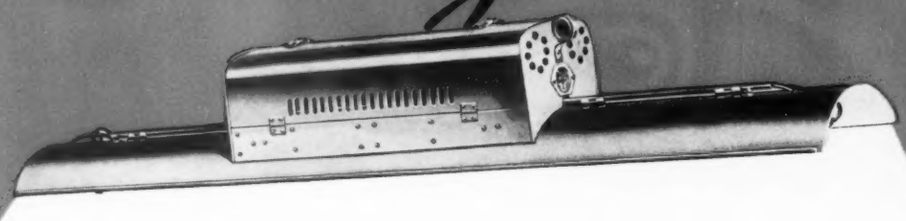

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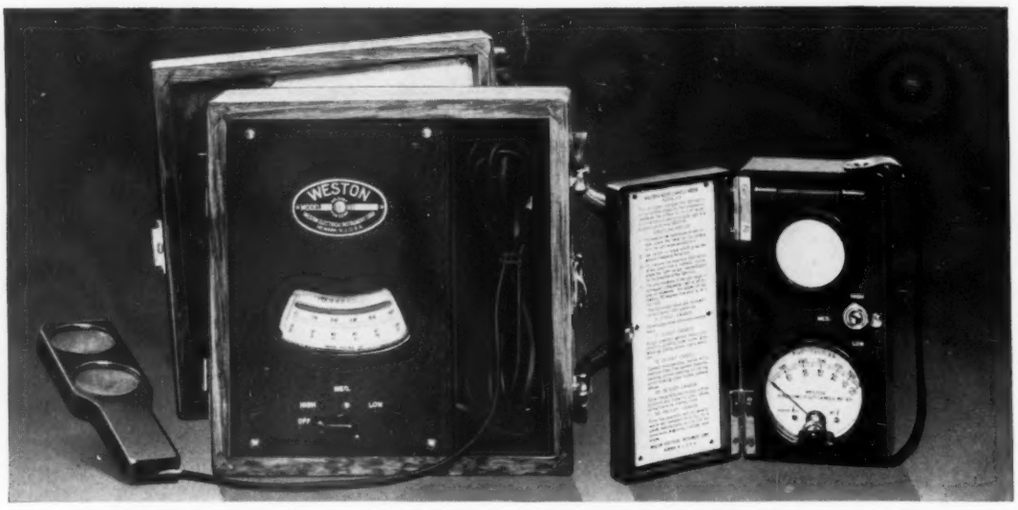

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Coming Features

How About This Air-Conditioning Load

Questionnaires from utility companies located all over the United States, now coming back to ELECTRICAL WORLD, show sharp differences of opinion on the benefits of commercial air-conditioning loads. Today's opinions of utility companies on air conditioning-co-operative activities, dealer relations, revenues, advice to customers, installation, financing and servicing will appear in the air-conditioning symposium February 27.

Expulsion Breaker Field Tests

Tests show high interrupting capacity, three-cycle arcing times, minimum contact and oil deterioration to be attainable under heavy duty conditions.

Conveyor Control Expedites Product Handling

Centralized operation of conveyor units increases flexibility, minimizes delays and lowers cost of warehouse movements.

Trolley Coaches Increase Power Sales

Trolley coaches rescue disappearing trolley load and create new avenues for power sales.

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VOLUME 107 . . . NUMBER 7

Contents Copyrighted, 1937, by McGraw-Hill Publishing Company, Inc.

ELECTRICAL WORLD—Published every Saturday. Price 25 cents a copy. Subscription rates: United States, Canada, Mexico, Central and South American countries, $4 a year; all other countries, $6 or 24 shillings a year. Entered as second-class matter November 16, 1936, at Post Office at Albany, N. Y., under the Act of March 3, 1879. Printed in U. S. A.

Branch Offices: 520 North Michigan Ave., Chicago; 883 Mission St., San Francisco; Aldwych House, Aldwych, London, W.C. 2; Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Atlanta, Ga.

McGRAW-HILL PUBLISHING COMPANY, INC.

Publication Office: 99-129 North Broadway, Albany, N. Y.

Editorial and Executive Offices: 330 W. 42d Street, New York, N. Y.

JAMES H. McGRAW, JR., Chairman — MALCOLM MUIR, President — JAMES H. McGRAW, Honorary Chairman

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ELECTRICAL WORLD

FEBRUARY 13, 1937

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Co-operation Does Not Mean Surrender

When the American electorate on November 3 returned President Roosevelt to the Presidency for a second term, thereby clearly voicing its approval of his then program of legislation, it was a signal to American business to so adjust its operations as to be in tune with the new social and economic trend. Such has been our attitude and we have urged co-operation with the agencies of the government on the part of the electrical industry wherever it is possible.

Co-operation, however, does not mean surrender!

For the past month the people of the United States have been treated to the spectacle of the "Battle of T.V.A." This was the third round in what may be a "fight to the finish," but which in all probability will end in a draw, due more to the exhaustion of the public patience than anything else. T.V.A. won the first round in the Supreme Court decision upholding the government's right to distribute power from wartime Wilson Dam at Muscle Shoals. The utilities won the second round when Judge Gore granted nineteen electric companies an injunction to prevent the T.V.A. from expanding its power activities in unfair and subsidized competition with them. The third round ended in a draw on February 3 when the T.V.A.-Commonwealth & Southern contract was not renewed.

During this last phase of the battle we have been amazed at the uncompromising and unsportsmanlike attitude of those in T.V.A. who are opposed to private ownership. First, as justification for breaking off negotiations with the utilities on a southeastern power pool, the power companies were charged with unclean hands and lack of co-operation because of the Judge Gore injunction. Secondly, as justification for not renewing the interchange of power contract, the T.V.A. charged the Commonwealth & Southern company with demanding a monopoly in the distribution of government-generated electricity.

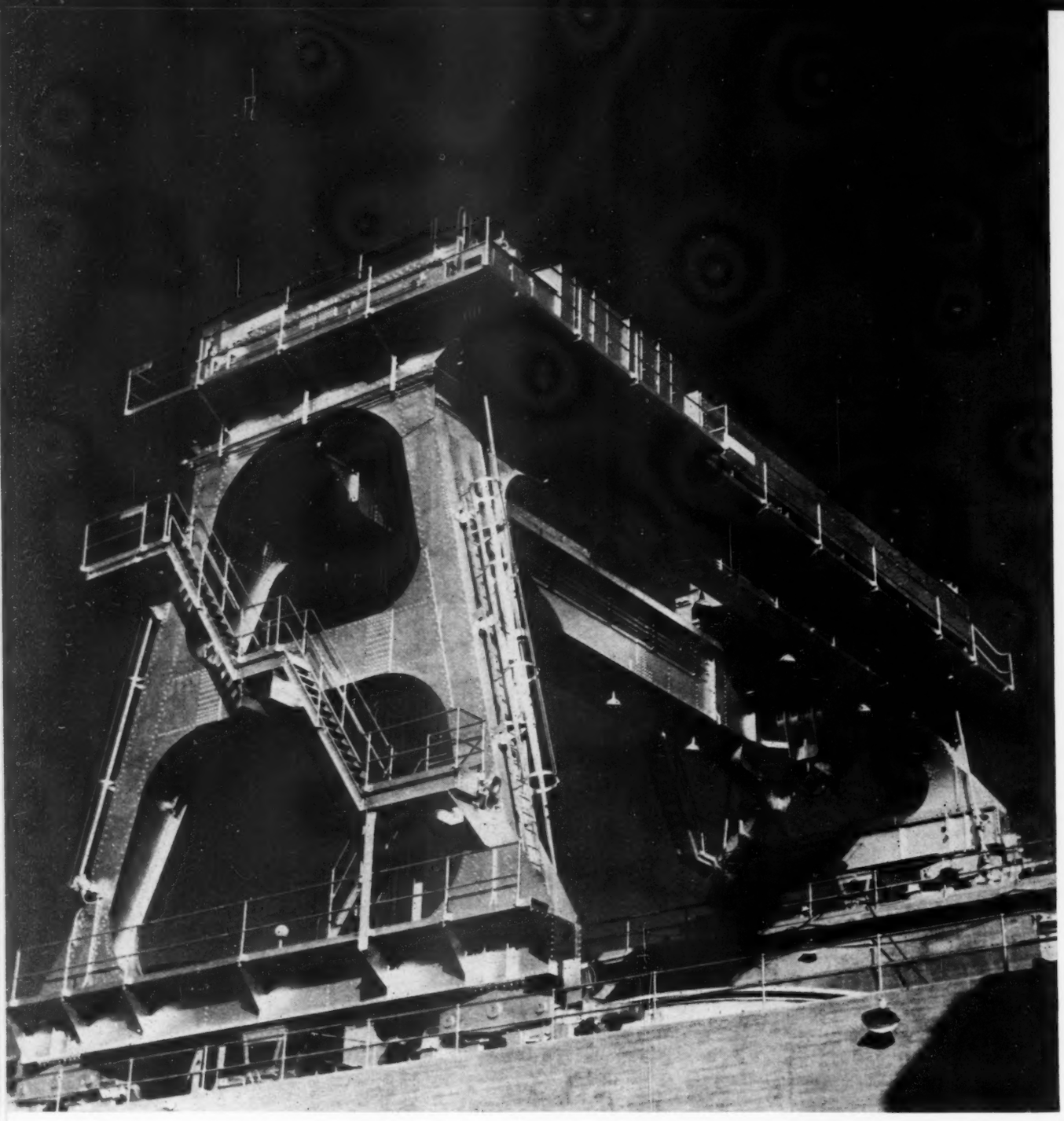
Both of these charges are insincere, calculated distortion of the truth, and purposely designed to arouse public antagonism against the utilities. They are premeditated blows below the belt.

The utilities filed their suit for injunction in May, 1936, more than four months before the President called his power pool conference on September 30. Even then Mr. Willkie, president of Commonwealth & Southern, stated that the suits would not be withdrawn unless the government agreed to cease unfair competition. If that action was lack of co-operation in January, was it something different in the preceding September?

The second foul blow was charging the Commonwealth & Southern with demanding a "monopoly" in the four states in which it operates as the price for renewing the T.V.A. power contract. What the company did state was that in the event it purchased power from T.V.A. the latter should not compete with the company in the area in which it distributed that purchased power, nor should T.V.A. sell power to others to compete with the company in that same area. Is that a demand for a monopoly, or is it just plain good business sense?

This is not the problem of one utility system; in its determination will come the principles that will govern the relationship of government to private utilities throughout the nation. Those who are opposed to the judicial and fair-minded method of dealing with this problem, as proposed by Dr. A. E. Morgan, want to absorb the private utilities, but they have no intention of paying a fair value. They are giving the utilities the option of fighting or unconditional surrender.

The electric utilities are still ready to cooperate with the government in marketing T.V.A. power through almost any reasonable form of regulation, but as for surrender—never as long as the savings of hundreds of thousands of investors in the industry are in jeopardy.



A T.V.A. GIANT

Heavy work at the outdoor power plant of the T.V.A.'s recently completed Wheeler Dam is done by this 270-ton double-trolley gantry crane. Each of the crane's trolleys is equipped with a 135-ton main hoist and a 25-ton auxiliary hoist. Both main and auxiliary hoists are powered with 60-hp. motors. Trolleys are operated by 15-hp. motors. The crane itself is propelled along its tracks by a 260-hp. motor. This heavy lifter is 52 ft. high and has a 69-ft. span.

A.I.E.E. Talks Performance

Convention Well Attended—Emphasis on Practicality in Active Discussions of a Wide Range of Subjects

More than ever the recent winter conclave of the A.I.E.E. served as a practical forum at which utility engineers and manufacturers were given an opportunity to "thresh out" mutual problems relating to the performance of equipment, its design and economic application to power systems. Discussions were directed for the most part to the practical aspects of system operation as related to equipment design and appropriate application.

The program was particularly well balanced, with attention being given to a wide range of subjects in the 58 papers presented. Lightning, electronics, secondary overcurrent protection, overhead secondary economics, protective devices, meter ratings, transformer standards, welding and welding controls, tensor analysis, electrophysics and communication all came in for their share of attention. Here condensed are the significant reactions expressed.

Protective devices surveyed

For the first time a high-voltage transmission circuit has been reclosed at the maximum speed the physical phenomena, especially arc deionization, will permit. This accomplishment of instantaneous reclosure after a fault was reported in the paper jointly by Philip Sporn and D. C. Prince. Its ultra high-speed performance rests in part on the one-cycle carrier relaying described in detail in ELECTRICAL WORLD October 12, 1935. Arc extinguishment takes place in 5 to 6 cycles and, with the new double-spring breaker mechanism applied, reclosure is effected in some 17 cycles after initiation of the trip impulse. Tests on the 132-kv. line showed some 14 cycles to be about the shortest time which would not incur restriking of the arc after de-energizing. The prophecy was hazarded that ultra high reclosing may eventually make possible a reduction in investment of duplicate lines to give uninterrupted service to large industrial loads. At least in the tests on a set-up equivalent to 340 miles of single circuit reclosure was effected with recovered synchronism and during a transfer of 40,000 kw. of load with phase displacement of 41 deg. Certainly the new development forces a revision of the thinking about circuit breakers. It not only is to open safely but to reclose at once, only the breaker and the operating force being aware of the fault clearing and recovery.

Instantaneous reclosure is a matter of four years standing in the Tennessee Electric Power Company, said E. E. George in recalling the first reclosure (on 44 kv.) in October, 1931. His expectation is that it will ultimately "let one line do most of the work of two most of the time." J. B. MacNeill (Westinghouse) concurred with the authors that the function of the circuit breaker is to clear troubles so that service may be uninterrupted. He believes the trend will be toward shorter opening travel of the contacts in holding down reclosure time. Whatever is saved in opening time is made available to insure deionization before reclosure. He questoned the ability of the average maintenance man to keep so intricate a high-speed mechanism in order, but author Prince (General Electric) assured him that subsequent designs would be much sim-

Utility men "gang-up" for a chat about trucks. C. T. Hughes, Connecticut Light & Power Company, left; C. W. Mayott, Connecticut Valley Power Exchange, center, and J. R. North, Consumers Power Company

Maybe I. W. Gross, American Gas & Electric, left, is talking transformer insulation with Prof. C. L. Dawes of Harvard, right. Harold Moore, Rockbestos Products Corporation, is at right in background

pler than this first experimental one.

V. M. Marquis (American Gas & Electric) said both lines would have high-speed reclosure after the second line is built to connect the Twin Branch plant with Fort Wayne, a link in the system from Philo to Michigan City.

Control gap for lightning

Amplification of the control gap description given in ELECTRICAL WORLD (September 26, 1936) was afforded by the Ohio Brass authors Ralph Higgins and H. L. Rorden. It showed how to combine the virtues of the sphere and rod gaps to attain something superior to either. Comment on the development was vigorous, but unfortunately the chairman afforded the authors no opportunity for closure, so what Ohio Brass has to say in rejoinder must wait.

Three inherent disadvantages of the sphere gap and the poor impulse characteristics of the rod gap were emphasized by K. B. McEachron (General Electric), who said that "it seems quite obvious that any scheme which secures the impulse advantages of the sphere gap through control of flux (which is the same means the sphere gap itself uses) will be subject to the same wet and dry sparkover values if the same impulse characteristics are secured." Further, lightning arresters whose spark potentials are not affected by the weather can be designed for much closer protection than gaps because their spark potential need not be above the switching transient levels.

V. M. Montsinger of the same company added the following: "Considered from the standpoint of protecting transformers in the field against direct strokes, the sphere gap might be considered ideal except for the fact that it must be kept dry, since a single drop of water on the surface reduces its 60-cycle flashover to as low as one-third its dry flashover. To set it high enough to prevent flashover from switching surges under wet conditions would not provide the necessary protection against lightning. Furthermore, power follow current would destroy the spheres."

E. S. Bundy, Buffalo, Niagara & Eastern Power Corporation

Discrepancy in time lag of the rod gap was noted by A. C. Monteith (Westinghouse), who said his data supported 1.8 microseconds for a 138-kv. installation at 860 kv., whereas the paper by Higgins and Rorden showed 3.3 microseconds. This is significant because only in the questionable zone can the authors claim superiority of the control gap over the rod gap.

A more encouraging criticism was offered by I. W. Gross, who coupled the control gap of Higgins-Rorden with the ultra high-speed reclosure of Sporn-Prince.

The control gap appears from the data to have considerably better protective characteristics against steep wave front surges than the standard rod gaps, although it still has the undesirable rising characteristics at short time lags.

Based on the data given in the paper, a trial design for 132-kv. application with standard 132-kv. transformer insulation showed that the control gap allows some 20 per cent higher magnitude of switching surge voltage without flashover as compared with a standard rod gap set for the same protective voltage level at one-half microsecond. This is a margin that may well be considered when attempting to supply better protection against steep wave fronts, and at the same time reduce line outages due to switching surges to a minimum.

With this set-up of an inexpensive protective gap and ultra high-speed reclosing breaker a reasonable frequency of line flashovers due to switching surges could be tolerated in many cases, as the circuit would be re-energized immediately without objectionable energy interruption. The frequency of breaker operation allowable would depend largely on breaker maintenance and the degree of risk taken as regards the gap protecting the apparatus on steep wave fronts.

Should such a protective scheme as outlined above prove effective, it would entirely change the present requirements for lightning protection of transmission lines, the continuous ground wire, low tower footing resistances, and counterpoises not being necessary.

Lightning more subdued

Tripouts have been reduced in the ratio of 20 to 1 by effective application of ground wires. More recently the tower-to-tower buried ground wire in at least one instance has entirely eliminated flashover at a spot previously very susceptible. W. W. Lewis and C. M. Foust brought this out in their paper rounding up and interpreting nation-wide data. Further corroboration was supplied by Edgar Bell from the 220-kv. Wallenpaupack-Siegfried line in that flashovers are occasioned only by high tower-footing potential exceeding line insulation strength, the counterpoise preventing concentration of earth currents at tower footings.

A. W. Gothberg and A. S. Brookes (both of Public Service Electric & Gas Company, Newark) accepted all this and proposed a form of line construction which they will follow in rebuilding several lines in the imme-

D. M. Simmons, General Cable; H. O. Anderson, Rockbestos Products Corporation, and T. A. Worcester, General Electric Company

diate future. The scheme, designed to afford a 75 per cent reduction in lightning outages at moderate cost:

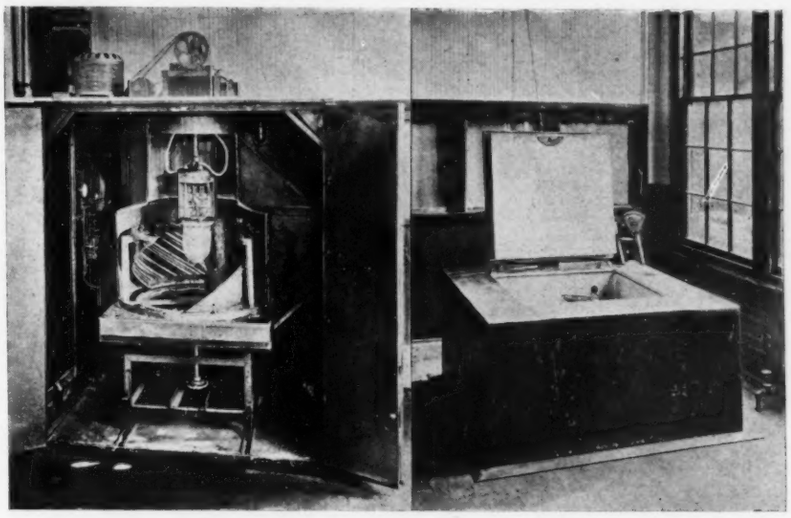
1. One phase of each circuit is made a shielding conductor by locating it so that the remaining conductors will be shielded from direct strokes.

2. Lightning currents are drained from the shielding conductor by lightning-protector tubes.

3. The remaining phases are isolated from the shielding conductor and tube ground circuit by insulation sufficient to prevent phase-to-phase faults.

Discussion of these three papers reflected little of the old discussion when lightning had not even yet been proved to be more direct than induced in origin and manifestation. This is progress comparable to the progress in line performance. S. K. Waldorf said the P. W. & P. Co. Westport-Takoma line (230 kv.) had only one outage in five years; another line had functioned two years with none and a 69-kv. line had had no outages since tower-footing resistances were reduced to 20 ohms. I. W. Gross, citing inferences from tests and performance on the American Gas & Electric system, said that currents passed by counterpoises are about proportional to their lengths. Short ones behave like ohmic resistance, but the longer ones, on the contrary, give unexpectedly large effectiveness from the standpoint of current collection and diffusion. L. V. Bewley had used this term diffusion along with "suction," but Foust, for the authors of one paper, repudiated it as "infra dig." As for Bewley's comment that none of the currently reported conclusions in any way refuted the wave theory, Foust said the Lewis and Foust team denies ever having caught up with the elaborate wave theory; they still approach lightning as an Ohm's Law phenomenon, with some suspicion of culpability on the part of a condensive earth.

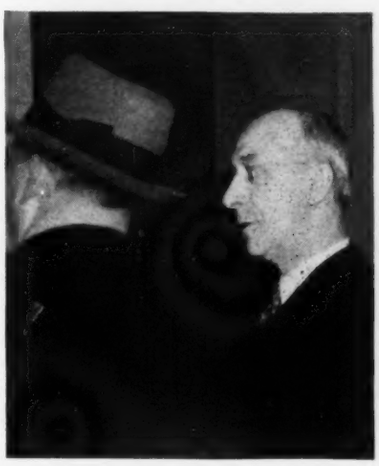
Counterpoises are not yet common, as shown by the R. D. Evans committee report on power system stability, in which only five lines have any form of counterpoise out of 49 for which stability data are given. Three lines are in the Pennsylvania-New Jersey (230/132-kv.) interconnection, one the new Boulder-Los Angeles line (287 kv.) and another the 187-kv. Ile-Maligne-Quebec line of the Shawinigan Water & Power Company. The report was commended by A. C. Monteith (Westinghouse) for its comprehensive round-up of the elements, technique, data and bibliography on stability.



A weatherometer for simulating all kinds of weather conditions from desert heat to soaking rains is shown at the left. It is used for accelerated aging tests of finished wire and cable at the Hastings-on-Hudson plant of Anaconda Wire & Cable Company, visited by convention delegates. At right is the refrigerator for cyclic cold tests

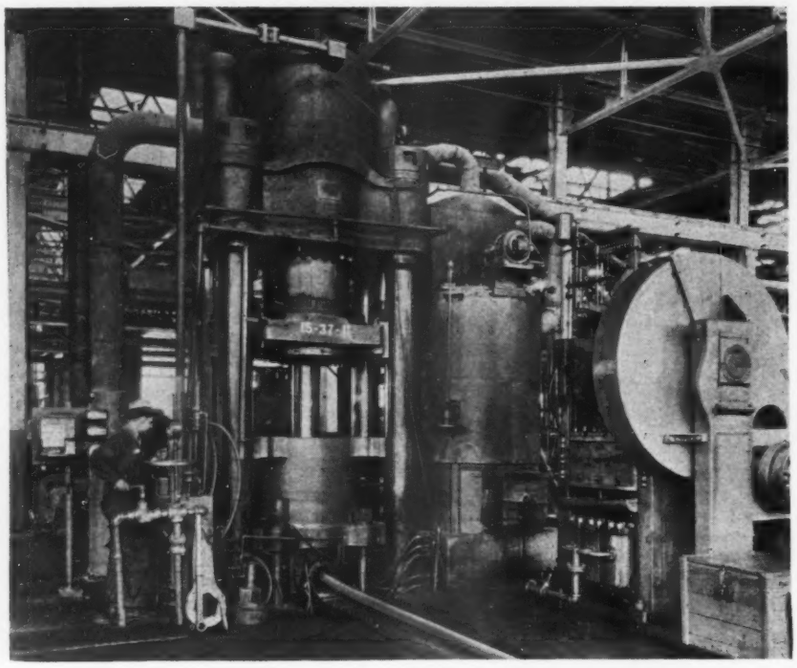
Distribution studied critically

Boosters, secondary over-current protection, pole flexibility and progress in overhead secondary design were the topics projected for discussion on Tuesday afternoon. In view of the expectation that the National Electrical Safety Code may soon be reopened for revision, possibly to ease its stringency for rural lines, the H. P. Seelye (Detroit) paper and subsequent discussion on the economic gain from capitalizing on pole flexibility in design was of interest. The paper said that inability to guy at dead ends, at lamp spans and at some angles had forced the study of flexibility of unguyed poles. It led to the conclusion that suitable design data (afforded by a group of nomograms) would allow sag adjustments to be made so as to utilize advantageously the bending of the poles. A. B. Campbell attributed to flexibility part of the credit for many lines that survived storms under which they should surely have failed, using the prevailing rigid strut concepts. Also, a rigidly guyed pole is less proof against shock. In his opinion the Safety Code rule may have been the best answer at the time of its adoption, but later studies indicate that reasonable advantage should be permitted to be had from the availability of pole flexibility.



John Lapp, president of the Lapp Insulator Company

Previous reports on the Boston (1934), Duquesne (1934), Philadelphia (1934), West Penn (1928) and Detroit (1935) systems were digested and correlated by W. P. Holben of the Duquesne Light Company to get at economies of wire size, transformer spacing and size, and expansion policy. Except where appliance load flicker requires No. 2 wire, the most economical secondary is found to be No. 2, No. 3 or No. 4. Furthermore, 15 kva. transformers have proved to



A large lead press—one of the many sights at the Anaconda Wire & Cable plant, visited by A.I.E.E. "convengineers"

be best for average residential loads.

It must amaze many engineers, said D. K. Blake of Schenectady, to learn from this paper that it is as economical to use smaller wire and smaller transformers at shorter spacing. With that accepted, Blake finds little in the paper to support those who talk everywhere about overloading transformers to make them pay. At the very least avoidance of overloading means avoiding the cost of making load tests and these, when well done, are not exactly inexpensive. Harold Cole (Detroit) also emphasized the little difference between Nos. 2, 3 and 4 wire when transformer size and spacing are chosen to correspond. The master plans devised in Detroit, not only for new development areas but also for built-up sections, have proved a distinctly profitable venture, and so, in execution of them, is the banking of transformers on secondaries to enhance reliability, economy and flexibility.

Overcurrent protection in distribution practice

Protection of consumer service is important, and with practically no duplication provided in distribution equipment stress has to be laid on protective accessories. This was brought out by G. F. Lincks and P. E. Benner of General Electric in their paper correlating the various trends of thought on co-ordination of fuses with one another and with breakers. They arrived at the conclusion that the external fuse cutout with renewable fuse links enables the use of the lowest possible fusing practice. They asserted that omission of primary fuses virtually adds miles of exposure to cause trouble and an equal number of miles to patrol to locate it. Another conclusion was that a practical arrangement for automatically combining sectionalizing fuse and automatic reclosing protection so as to differentiate between temporary and permanent faults should give superior results.

To accomplish any saving in transformer failure fusing would have to cost no more than 75 cents (including installation) on 1½-kva. transformers and 35 cents for 10-kva. This assertion of H. P. Seelye was based on Detroit experience in losing only 75 out of 30,000 transformers in three years (and these were mostly small ones) due to secondary shorts or overloads. The Lincks-Benner paper favored loose banking, with fuses between transformers, rather than the solid banking, with fusing in the transformer leads, as practiced in Detroit, and Seelye interjected here the fact that there have been only four instances of cascading in several years experience involving about 20,000 transformers in the Detroit scheme. The bigger banks seem to burn off what faults occur.

Step boosters for voltage

Automatic voltage boosters reduce the cost of correcting a low-voltage condition on any feeder of more than average length where correction otherwise would require the installation of large conductors in the three-phase portion of the circuit. But this does not justify the tendency to multiply boosters indefinitely, said L. M. Olmsted in his Westinghouse paper, and retain the original conductors unduly long because the excessive losses increase the annual cost of the circuit. The author favored two steps of 1.33 per cent each, but P. E. Benner (General Electric) differed with him, believing the additional 1 per cent of voltage available with a third step is well worth the added cost. Further, he suggested that the range of boosters be geared to the average rather than to specific regulation needs so as to permit the standardization and volume of output which foster lower prices.

Effectiveness of the eight-step regulator would be above that of the induction regulator, in the opinion of L. H. Hill (Allis-Chalmers), if the eight steps were of ⅝ per cent each to match the 5 per cent permissible voltage regulation. He cautioned also that the distribution booster has the same kind of service to render as the station type regulator and, worse, will often get little attention until it fails. Also, on a less compact system than that related to the Olmsted paper, the advocacy of fewer steps might be less appropriate.

J. A. Brooks (Flushing, N. Y.) felt the current-control type of booster has been dismissed too lightly. For suburban loads the power factor and circuit impedance are constant and the only variable is the load current, and it would be logical to let it actuate the correction.

Inductive co-ordination of distribution and telephone circuits

Data and conclusions set forth in the paper by Coleman and Davis on inductive co-ordination of common neutral power distribution systems

and telephone circuits was substantiated by E. A. Taylor (Bell Telephone Laboratories), who presented the results of field tests in rural areas similar to those of Coleman and Davis. He found, as did the authors, that it was the higher harmonic-frequency components induced in the telephone circuits from power system harmonics that were of major importance from the noise standpoint. Mr. Taylor's data indicated that ground-return charging currents on power distribution circuits were more important as a source of telephone noise than the transformer exciting currents, and that the effect of these currents could be improved by improving the wave shape. Favorable results in shielding telephone cables were obtained by Taylor by bonding the telephone cable sheath to the power system grounded neutral in exposed locations.

E. E. George (Tennessee Electric Power Company) raised the question of mitigation of noise due to the new grounded neutral rural lines on existing "wildcat," party or ground-return telephone lines frequently found in the rural areas. Mr. George felt that although Coleman and Davis data applied well to the more domesticated cable and metallic return telephone circuits, it did not apply to the ground-return lines. In reply to George's remarks Coleman pointed out that from a noise standpoint it is impossible to have extensive rural electrification and ground-return telephone lines in the same area. It had been implied that telephone circuits would have to be rebuilt in these cases. Whether they should be rebuilt at power company expense was a question that troubled Mr. George not a little.

Impulse strength of transformer insulation

Conclusions drawn from tests on full-size commercial transformers and from data in Bellaschi and Teague's paper on the dielectric strength of transformer insulation were questioned by I. W. Gross (American Gas & Electric Company), who found difficulty in understanding why tests in a certain region of the curve should be considered excessive when it was noted that one transformer withstood fifteen tests in this region in which wave rose to crest in ½ to 1 microsecond. Authors of the paper later during the discussion reported that examination of the insulation of transformers in region E revealed damage. Gross further pointed out that since the transformers withstood tests at similar voltage test conditions at which oil and fullerboard failed, the transformers may have a safe impulse strength at some points on the curve greater than the values at which they were tested.

H. H. Rudd of Railway & Industrial Engineering Company

A better gage of dielectric strength of insulation is the point at which corona starts to damage the insulation, according to V. M. Montsinger in discussing Bellaschi and Teague's paper. For average conditions Montsinger reported this as 80 per cent of the single-shot breakdown value and applies to solid or solid and oil insulation in series. It was stated that the main difference between the authors' views and those of Montsinger were that the authors feel that when short or front-of-wave tests are made on transformers the kv. values should not be allowed to exceed the kv. values used for the full-wave tests, whereas the views of Montsinger based on test indicate that a somewhat greater increase in kv. values can be used when testing on the front of the wave. Montsinger further pointed out that under repeated voltage conditions the impulse strength of the major transformer insulation is obviously lower than 2.2 to 3 times the 60-cycle, one-minute strength.

Transformer standards proposed

After two years' effort, the transformer subcommittee (J. E. Clem, chairman) brought forth suggestions for changes in the current A.I.E.E. transformer standards. That these proposals will undoubtedly undergo more change before adoption was indicated by the discussion. Thus I. W. Gross (American Gas & Electric) called attention to the undesirability of designating impulse strengths in inches of rod gap and also that no relation is stated between gap spacing and the impulse strength. Further, he suggested that, to avoid the confusing prescription of three test waves, crest and voltage and duration be specified and each laboratory left to operate with appropriate equipment to meet the specification. K. B. McEachron (Pittsfield) concurred and said there was little reason for continuing the gap method of expressing impulse voltages in the light of general acceptance of the kilovolt equivalent. He

Three educators in cheerful mood. They are, from left to right, Dean P. H. Daggett, Rutgers; C. F. Scott, Yale, and R. E. Doherty, president of Carnegie Tech

also raised the question of unpredictable flashover of other windings of multi-winding transformers than the one chosen for impulse test and suggested modification of the proposed standards to provide for the test adaptations that are used to avoid confusing results.

Cable stability correlated

Accelerated cable aging tests at Commonwealth Edison, reported by Halperin and Betzer, brought mild dissent from cable manufacturers on the matter of ratio of test to working voltage to employ. In fact, the manufacturers' spokesmen differed from one another on this point. At Chicago 2½ times normal voltage was applied, but W. A. Del Mar said Habirshaw uses four times working voltage and R. J. Wiseman said Okonite uses 3½ times. Del Mar gave credit for the idea that load-cycle life test does give an index, without having to wait for failure, by correlating power factor, ionization, pressure and vacuum behavior to prognosticate, or at least anticipate, a much-delayed failure. Further, he felt that the test voltage should be a multiple of the maximum working stress on the dielectric to allow for differences in test cables. He also was pleased that the Chicago authors had a good word to say for rosin because he had stood by it when others deprecated it generally. Rosin does improve some cable oils, but completely ruins others.

Europe uses hardly up to 50 per cent over working voltage for test stress, said Wiseman, and he still does not feel that such tests as made at Chicago are indicative of field conditions, and further he believes in stress nearer to the working stress. On the matter of oils, it was predicted there would be a trend toward a moderate amount of blending to compensate for refinery variations.

Rosin, according to L. F. Hickernell (Anaconda) is useful in increasing stability. He put stress on the fact that Halperin had more cables with rosin that were stable than the unblended type. In closing, the authors repeated that stability of insulation is the primary requisite; long life is the economic objective rather than initially low dielectric losses. In the paper they had said "cables of recent manufacture frequently show only fair stability" when tested by the method which provoked all the discussion.

Dr. Joseph Slepian, Westinghouse, chuckling over a fall he won from Gabriel Kron in the wrestling over tensor analysis

Active interest in tensor analysis

Tuesday's all-day session on tensor analysis contributed greatly to a wider understanding by engineers in general of the significance and realm of application of this comparatively new engineering tool. Originally developed as an aid to advanced geometrical analysis, tensor analysis is claimed by its proponents to have effected considerable simplification in the analysis of complicated electrical systems.

Tensor analysis allows the engineer to use the same scalar equations developed for a simple system having one degree of freedom to describe the behavior of complex systems with any number of degrees of freedom. It allows use of the same symbolic equation for an infinite variety of problems in which the physical laws are fundamentally the same simply by using a group of "transformation tensors" to care for different network connections.

Gabriel Kron, General Electric's tensor exponent, scans his program for another chance to argue

Discussion of the papers of Kron, Boyajian and Bewley by Banesch Hoffman of Princeton and later by Dirk J. Struik of M. I. T. stressed the importance of these papers in introducing a new analysis tool for engineers.

As with all new concepts, difficulty has been experienced with the definition of terms such as tensor, vector, polyadic and others used in the papers on tensor analysis. Dr. Joseph Slepian (Westinghouse Electric & Manufacturing Company), in discussing the papers of Kron and Boyajian, called for consistency, sufficiency and permanence in the definition of tensor terms. He found a lack of adequate definitions for vector and tensor as used in Kron's paper, which he found to be different from other similar definitions. Dr. Slepian doubted the validity of some of the equations derived in Kron's paper because of the lack of definition of certain terms.

Karl L. Wildes pointed out in the discussion of Pen Tung Sah's two papers that Professor Sah's dyadic algebra and complex vectors applied only to three-phase problems and were therefore limited. Wildes felt that judgment as to the justification for Sah's and Kron's methods should be witheld until it could be determined whether they clarify or confuse the theory involved. Dr. Slepian felt that a redefinition of Sah's scalar product might lead to a geometry more similar to that of vectors with real components.

Precipitator to rival refrigerator load

On the horizon is a utility load of 65 watts on all the time that is the earning equivalent of a 200-watt refrigerator on one hour in three. It is a new electrostatic precipitator, described in the G. W. Penney (Westinghouse) paper, which differs from conventional designs largely in the small amount of energy needed and in the fact that the ionization is com-

[*Continued on page* 131]

Urges Polyphase Agricultural Motor

British Authority Records His Impressions of the Handicaps to Farm Electrification in America

By R. BORLASE MATTHEWS
East Grinstead, England

Among the many Europeans attending the World Power Conference were several who had extensive experience with forging other nations far ahead of where the United States is today in agricultural electrification. R. Borlase Matthews has had electro-farming consulting contacts with the British Empire, and when he told the editor of them and also his size-up of our status, after visiting many farms in Illinois, Michigan, New York, Pennsylvania and New Jersey, we asked him to give us the following commentary. Motor producers will be startled by the 80 per cent market built up in Europe.

THERE seems to be very little doubt that in about ten years America will be ahead, and well ahead, of the rest of the world in farm electrification. The question is as to whether it would not be advisable to shorten this time. Rural electrification organizations are of a very excellent character with very enthusiastic staffs, who are closely in touch with the true spirit of farming and keep in contact with college agricultural departments and their extension officers.

Obviously an exception must be made of the prairie type of farming and cattle ranches where mixed farming is not carried on. Apart from these, an extraordinary number of farms already have an electricity supply and it would seem that before long, where mixed farming is carried on, the remainder will soon be connected to the supply mains.

Generally speaking, the prices charged for electricity are almost everywhere favorable from the farmer's point of view, except in those cases where there are "installed motor" restrictions. The point of interest to an electricity supply undertaking is, of course, the maximum demand and load factor and not the "installed connections." The trend of modern electrical installations on farms is to utilize a large number of individual-drive motors (in spite of theoretical calculations to the contrary) as they economize very much in labor and, further, get the work done more quickly. The number of hours use of each motor, however, is comparatively short per annum, and this, coupled with the fact that a farmer always carries out his operations in series and not in parallel, means that "installed motor" ratings can be neglected in charging.

There is a very great handicap in America in that there is not yet available any very wide range of combined electric unit agricultural machinery. In almost every case arrangements (generally very ingenious, but often very expensive) have to be made to drive machines which are really designed for oil engine and countershaft drive. Another big handicap, except in California, is the use of single-phase current, which means more costly motors for the farmer to buy, on which also the maintenance is greater. It would seem that the time has come when the question of three-phase versus single-phase supply for farms should be very seriously reconsidered. For one thing a considerable and important farm load cannot be built up on a single-phase supply. Then it is an important psychological factor to be able to point out to the farmer that an electric motor (three-phase of course) costs less than an oil engine.

If the practice of single-phase lines is to be continued the farmer certainly should receive a subsidy which would reduce the cost of the motors which he purchases to the equivalent of the prices for three-phase motors, as the cheaper the motor the more there will be installed. As it is, those engineers who are responsible for the balancing of the loads on single-phase lines are already expending much time and trouble in rebalancing, which means an added distribution cost. Every one has a good idea as to the enormous cost of replacing or rewinding electric motors when a change is made from 25 cycles to 60 cycles. It took 2,000 a.c. motors to replace the d.c. type at St. Louis. What will it cost in a few years time to change over from single-phase to three-phase on hundreds of thousands of farms? The use of three-phase means the building up of a bigger demand for current, hence the author suggests the slogan "Three-phase for Every Farmer" as a motto for the ambitious rural electrification engineer.

Specific agricultural motor needed

Up to fifteen years ago the European electrical manufacturers said that their standard industrial electric motors were quite suitable for the farmer—they were then forced, as the result of unfortunate experiences, to make special agricultural type motors. The American manufacturer says the same thing today, as he has not yet appreciated the need, since enough motors are not yet out on the farms to give rise to sufficient complaints.

In both Europe and America there is a crying need for a still newer de-

sign of agricultural electric motor. From investigations that he has made the author finds that the American farm industry needs *5,000 electric motors a week* of this type—a most attractive proposition to the manufacturer. In Europe the output of agricultural type motors has reached more than 80 per cent of the makers' total motor output.

In the way stands the vicious circle of the farmer who will not order until reasonably priced, combined motors and machines are available; the agricultural machine manufacturer who is waiting both for a suitable electric motor and for orders from the farmer, apart from the fact that he usually makes oil engines and is therefore prejudiced; the electrical manufacturer who is waiting for the agricultural machinery maker and for orders from the farmer. The electricity supply company is patiently waiting for all three, and when they come forward he will offer a three-phase supply to every farm. Something radical must be done to bring these hesitant but well-meaning forces together, to get co-ordination among people who are already doing excellent work.

It may be asked as to what the author means by an "agricultural motor." His definition is: A motor with many of the characteristics of a mining motor — especially dampproofness after long disuse—at a *lower cost* than a present-day three-phase, squirrel-cage motor. The author has given the matter some considerable thought and it will be of interest to know that such a motor can be produced; further, one that, by a change of connections, can be used on a single-phase or a three-phase supply (ready for the day when all farm supplies will be three-phase).

Change of attitude advocated

To sum up, the author's experience, based on more than seventeen years' work on his own 640-acre commercial all-electric farm, coupled with the advising of governments, electricity supply undertakings and farmers, is that the majority of those responsible for the electricity supply undertakings must approach the question of farm electrification from a different point of view from that which many of them hold today. The majority appear to be under the impression that the bulk of the load is to be obtained in the farmhouse, and this tendency is very evident in the returns of electric supply undertakings. There are practically no American undertakings supplying current for field purposes except in a few instances for soil heating—the excuse is too readily accepted that electricity cannot compete with cheap oil fuel on the farm (though the author has not noted any great use of oil engines in city factories, in spite of cheap oil).

A new standard of comparison for the saturation of farm loads is required in America, though it is difficult to say what it should be. On the Continent, in certain very fertile areas, more than 100 kw.-hr. per acre is utilized in the farm buildings. A consumption of from 50 kw.-hr. per acre can be looked upon as a reasonable average goal. On most American farms the figure is under 10 kw.-hr. per acre, and that is chiefly consumed in the farm house. Another reasonable goal is twelve motors per farm. All this points to the necessity of approaching the question of farm electrification from an entirely different point of view.

The author's own experience has shown that there is a tremendous load awaiting the supply engineer on most of the average farms and, furthermore, the electricity supply undertaking can make available to the farmer a source of power which will enable him to operate his farm on modern and efficient lines, bearing in mind that owing to changing economic conditions there are signs of very great alterations of farming methods and also of adoption of factory practice.

What is now required, therefore, is a thorough understanding on the part of the supply undertaking engineers concerning the new requirements of the farmer and also a well-informed agricultural public opinion as to the advantages of employing electricity on the farm. The author wonders whether or not, after all, the great need in rural electrification is more for good psychology than for engineering. America is faced with lethargic dealer and wiring contractor problems similar to those that exist in Europe.

Many of the mistakes of Europe in farm electrification are being repeated for lack of knowledge as to what has been done before. America should not, of course, copy Europe, but rather start from where she is at present. The general position of business in America seems to indicate a big boom in building within two years. This will mean a shortage in farm labor, hence it is all the more important that reasonably priced, proper and suitable farm electrical equipment should be rendered available as soon as possible.

A CHALLENGE TO ELECTRIC AND FARM EQUIPMENT MANUFACTURERS

Most of the farm machinery built today has been designed for horse power, tractor power and steam and gas engine power. Very little of it has been designed to take full advantage of electric power. Electric power lends itself better than any other to automatic control. In most cases no attendant is needed. This opens up a big field for automatic equipment which can be run for 24 hours a day if necessary. It offers the advantage of reducing the size of a machine, which reduces the cost to the farmer and the cost of electric service to him as well. It seems to me that the agricultural engineers of this country should demand, fight for and help to develop a complete line of farm machinery built especially to take full advantage of electric power. Unless this is done electric power will be used to operate equipment designed for some other kind of power and the result will be about the same as when the first automobile manufacturer put a gasoline engine on a buggy and called it an automobile. The equipment must be designed to fit the new kind of power before real efficiency is obtained and the full measure and advantage of the new power is realized.—GROVER C. NEFF, President Wisconsin Power & Light Company, to American Society of Agricultural Engineers.

Ground Relaying Economical

Low Cost Substitute for Bus Differential Relays Cuts Operating Time to a Minimum — Current Transformers for Metering Purposes Operate Relays Without Additional Burden

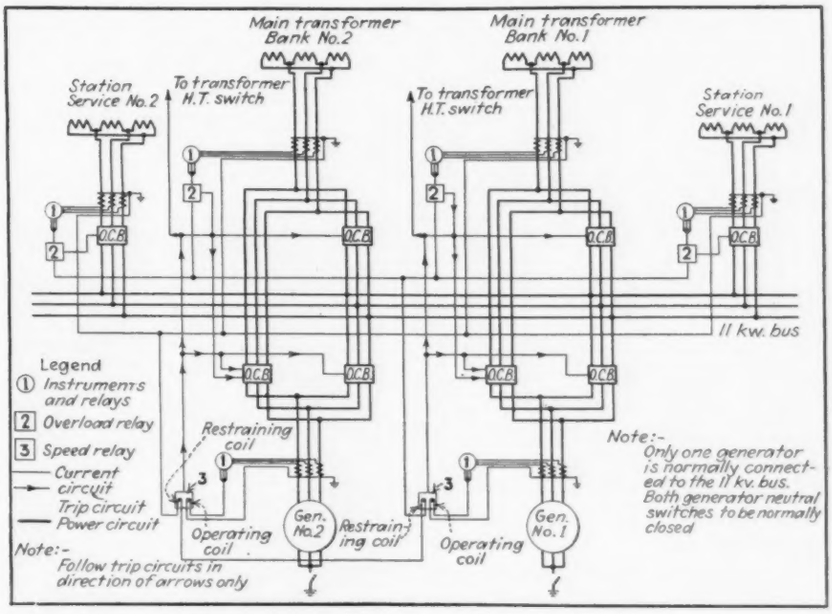
By **CHARLES B. CARPENTER**
Portland, Ore.

OVERLOAD relays for short-circuit protection of the equipment in a generating station ordinarily are satisfactory only as "back-up" relays because the time settings usually are so high that a fault may result in serious damage before the overload relays operate. Ordinarily, rapid and selective relay action in a power station is obtained by using differential relays for the larger generating units and transformer banks. The addition of "bus" differential relays results in a very satisfactory and complete protective relay arrangement, but the conventional bus differential relay arrangement is rather elaborate and expensive.

A relay arrangement has been devised as a substitute for differential protection of a generator bus. It provides selective operation of the relays by means of a circuit arrangement which permits the relay operation time to be reduced to a minimum. As the arrangement depends for its operation on certain characteristics of the bus, generator and transformer connections, its application, however, will be somewhat limited.

Referring to the main circuit connections in the accompanying illustration, it will be noted that the four transformers connected to the 11-kv. generator bus are all connected delta on the 11-kv. side. The two generators are star-connected and arranged for operation with the neutrals grounded. Ordinarily the station is operated with one generator on the 11-kv. bus and the other generator connected directly through its transformer to the high-voltage bus. They operate in parallel on the 11-kv. bus only during transfer operations.

As the generator bus is of the inclosed type, with buses carefully isolated from each other, and as single-conductor cables for the transformer primary connections are used the possibility of phase-to-phase faults is improbable. More likely are faults-to-ground due to the presence of ground insulator bases, switch frames and instrument transformer cases.



Schematic diagram of relaying for economic station protection

From the diagram, will be observed, for any one of the four transformer banks, a residual current in the circuit indicates a fault to ground in the primary of the transformer or its 11-kv. connections. This residual current can come only from a grounded neutral generator or generators connected to the transformer involved. It appears therefore that a ground relay connected in the common lead of the current transformers (as shown in the diagram) for a particular transformer bank will operate only in case of a fault within the transformer primary or its primary connections and that it will not operate in the case of a bus fault due to the fact that there is no source of ground current within the transformer. It will not operate on faults on the high-tension side of the transformer because all current in the primary is balanced current. This is equally true for all four transformer banks, each of which was equipped with a ground relay arranged to disconnect it from its source of energy upon a flow of residual current.

Bus ground faults will receive current only from the generators and such faults can therefore be isolated by means of ground relays connected to the generator current transformer in the same manner as the transformer relays. These would have to be provided with time delay selectivity in order to prevent relay operation in the case of transformer faults. To obviate this time delay the generator ground relays were provided with restraining windings with 25 per cent more turns than the operating windings. These restraining windings were connected as shown in the diagram. With this arrangement a fault in a transformer would result in the same current in both windings of the generator relay. If both generators were on the bus the operating winding of each generator relay would have only one-half the current that would flow in the restraining windings. The restraining windings, due to their larger number of turns, would control the generator relays and prevent their operation.

The occurrence of a fault on the bus or other place outside of the zone of protection of the transformer relays would result in current in the operating winding only of the generator relay, as no residual current can be fed back to the fault from the transformer. This would result in practically instantaneous operation of the relay; this relay is arranged to trip its generator and associated power transformer. Tripping the transformer prevents maintenance of an ungrounded power supply to the 11-kv. bus which is in trouble.

The main power transformers and generators are equipped with conventional differential protection. The station service transformers are equipped with overload protection only. Generators and transformers also are equipped with overload protection,

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Automatic Lighting Control Safeguards Children's Eyes

Double-Filament Lamps, Controlled by Photo-electric Cells, Maintain Desired Intensity on Desk Surface Despite Variations in Daylight

By DONALD P. CAVERLY
Lynn Gas & Electric Company, Lynn, Mass.

IN FEBRUARY, 1935, the city of Lynn, Mass., planned to build a new elementary school — one which the school authorities wished to be a model of modern efficiency and design. Among the high standards which they had in mind was a lighting system that would provide for every student the kind of seeing conditions desirable for physical well-being and maximum educational effectiveness. In fairness to the taxpayers, however, their attitude was tempered by typical New England conservatism—they wanted no "frills" which could not be justified from the standpoint of the over-all educational benefits to the community.

The vision and co-operation of George A. Cornet of Lynn, who had been chosen as architect for the school, made possible the opportunity to plan a lighting system which would best meet these standards.

At the start, of course, the necessity for lighting units of adequate wattage and efficient design to provide in excess of 20 ft.-candles on every desk during hours of total darkness was taken for granted. There is nothing particularly difficult or unusual, either for old schools or new, in thus assuring an *available* source of adequate illumination. However, the best lighting units in the world do not get to the heart of the problem—*proper utilization of artificial light sources* to maintain desirable illumination levels on every desk in day-after-day operation under varying conditions of daylight. A lighting system—like a heating system—can be no more effective than its control.

Although there was plenty of evidence that automatic lighting control to assure desirable illumination standards at all times was a sound investment from the standpoint of educational efficiency, plenty of problems still remained to be solved. In the first place, to use the 3,000 watts required for hours of total darkness whenever daylight on a single inside desk fell to the borderline level would be wasteful and unjustified. For example, if the system had been designed to produce a level of 30 ft.-candles in total darkness, and the photo-electric equipment was set to turn on the lighting if the natural daylight fell below 15 ft.-candles, then the total illumination in the classroom at the turn-on point would be 15 ft.-candles of natural daylight plus 30-ft. candles of incandescent lighting, or 45 ft.-candles. The cost of maintaining such a level of intensity, even for comparatively short periods of time, has been the stumbling block which has frequently retarded the progress of automatic control for classrooms in the past.

Furthermore, it is desirable that the wide range of natural daylight intensities from the windows to the inside wall be compensated for so far as possible in the lighting system itself. Otherwise, manual regulation of window shades within the classroom to level out peak intensities near the windows might counteract the benefits sought.

Flexibility secured in two ways

The increased flexibility obviously required to meet these problems had to be applied at two points: In the lighting system itself and in the automatic control of the system.

In the lighting system, use of the "3-lite" double-filament lamp, operating at 200, 300, 500 watts, offered a partial solution. Six such lamps are used in semi-indirect fixtures in each of the fourteen regular classrooms. These classrooms are 25 x 32 ft., with windows along the long side. The units are hung on approximately 10 x 12-ft. centers, about 3½ ft. down from the 12-ft. ceiling. Thus they form a double row of three lamps each, one 6½ ft. from the windows and one 6½ from the inside wall.

The filaments in each of these two rows of lamps are wired in separate circuits. In such an arrangement, providing four wattage levels on each circuit (including the out position), sixteen combinations are theoretically possible for lighting the room. As a means of aiding, rather than detract-

ing from, uniformity of illumination, however, the majority of these can be summarily ruled out. Indeed, when the normal ratios of daylight intensities across the room are considered, three of these combinations are found to be completely adequate in leveling out the peaks and valleys to a practical degree. They are:

Step 1—300-watts on row A	0 on row B (nearest to window).
Step 2—500 watts on row A	200 watts on row B.
Step 3—500 watts on row A	500 watts on row B (for total darkness).

It is safe to say that, even were manual control to be utilized, a switching arrangement limiting the levels available to these three would aid the uniformity of illumination in actual practice.

With the switching arrangement outlined above, a flexible system of photoelectric control becomes a practical possibility. As installed, the arrangement provides full automatic control of steps 1 and 2, from two separate photocell units. These maintain the critical illumination levels required in ordinary school hours. Step 3, adding the final 300 watts in the row nearest the window, is left under manual control, as it will only be required under conditions of practically total darkness.

Operating schedule of system

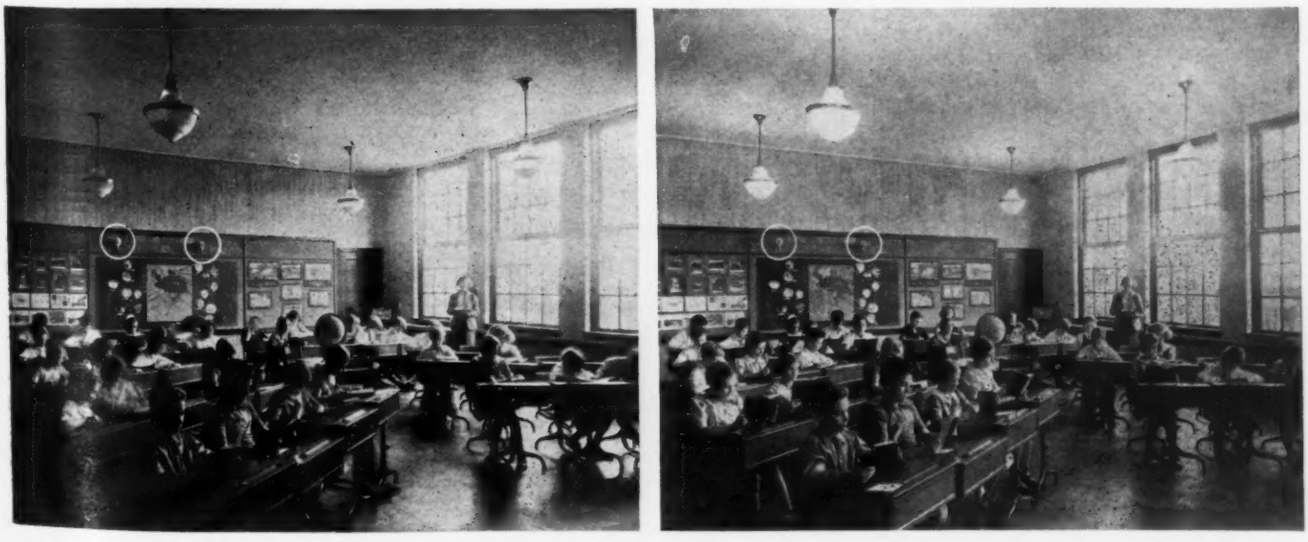
The operating schedule is as follows:

1. When natural daylight falls below 15 ft.-candles on the row of desks farthest from the windows control unit 1 turns on the 300-watt filaments on the inside row of lamps, thus adding 11 ft.-candles to the daylight on the desks in this area.
2. If daylight continues to decrease to a point where total illumination again falls below 15 ft.-candles on this same row of desks the 200-watt filaments in *all* the lamps are turned on by control unit 2, making a total of 500 watts per unit on the inside row. This increases the intensity by 9.5 more ft.-candles, giving this section of the room a 20.5-ft.-candle level from artificial light alone, plus 3 to 4 ft.-candles of natural light.
3. The remaining manually controlled 300-watt circuit brings the room to a uniform 26-ft.-candle level when daylight is zero.

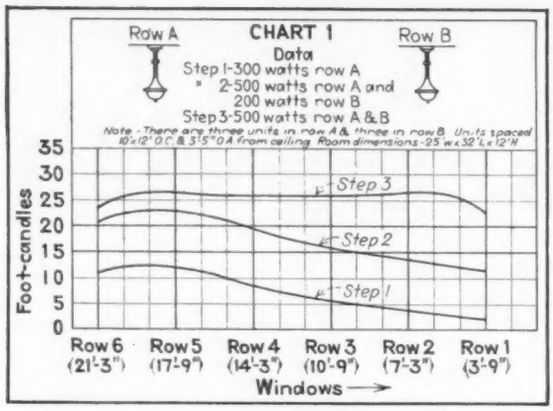
Informal seating arrangement is made possible in first grade by modern lighting. Circles indicate photo-electric cells

Originally the possibility of using a single photocell in the classroom with a double relay system operating in accordance with this schedule was considered. However, it was found that a considerably more positive and simple arrangement could be obtained using two individual Weston photronic cells and control units. As shown in the wiring diagram, this system utilizes an extra relay in one of the cell circuits to prevent the wrong sequence of operation, since the "turn on" relays operate when the desk-top illumination has fallen to the same level (15 ft.-candles). "Turn off" points in both of the control units are set at 30 ft.-candles. Here, again, the external relay assures proper sequence.

As the illustrations show, the two photocells are located several feet apart and do not both actually view the same level of illumination as that on the inside row of desk tops. The swivel joint used in mounting them, however, makes it possible to so turn



Striking evidence of a classroom illuminated by glaring daylight (left) and the same room with modern lighting (right). Circles indicate photo-electric cells



Intensity distribution of semi-indirect illumination in classroom (chart 1)

the cells that they pick up a constantly proportionate illumination, and adjustment of the control points can then be set to provide the predetermined level on the desk tops. In practice, the cell controlling step 2 operates in accordance with intensities on row 4, rather than row 6.

Units control two and three rooms

An installation of this kind would ordinarily make use of two complete photo-electric units for each room, and might thus face difficult obstacles from the standpoint of installation cost. For the Highland school the advantage of working along with the architect as the building was planned was of material advantage at this point. The rooms are so located and the building so designed that groups of two and three have identically the same exposure and can be controlled collectively from cells in a typical room of each group. A simple extra relay to carry the lighting load (on the three-room groups only) is the only extra equipment required to extend the control beyond a single room.

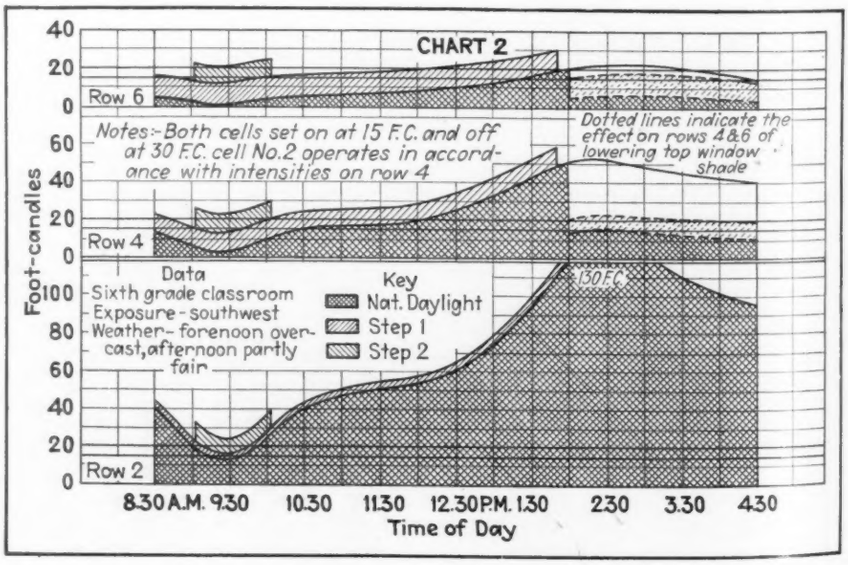
Only the two small photocells themselves are located in the classrooms, as self-generating cells of this type have sufficient output to operate relays without amplification over a considerable distance. It was advisable for the classrooms to contain as little evidence of the mechanics of control as possible, both from the standpoint of appearance and possible unauthorized interference. Furthermore, the wiring installation is considerably simplified when such an arangement is used.

The relays and panels are grouped in the corridors adjacent to the rooms under control. Small breakers which operate and protect each branch circuit are located in these panels, the only manual switch within the classroom being that which controls the final step 3 circuit. Keeping the manual control out of the classroom not only decreases the possibility of unauthorized interference with the predetermined operating schedule but relieves the teacher of responsibility for putting the control circuits in or out of operation at the beginning and end of the school day. Master switches in the basement, operated by the janitor, put the various groups of rooms into operation during normal school hours. At the panel boxes, rooms not being occupied during these hours, for one reason or another, can be instantly disconnected without interfering with the scheduled automatic operation of the others. While the longest run from photocell to relay panel is about 50 ft., considerably longer runs are possible with Weston equipment. This suggests the possibility, in future installations, of mounting all the relays in a battery in the basement control room, perhaps with time-lock control on the master switch for putting them in operation.

It is felt that mounting the relay in the classroom is not necessarily an advantage from the standpoint of setting the relay positions for the desired illumination levels. After a full set of illumination level readings have been taken, including that of the light impinging on the cells under each condition, the settings can be worked out on paper to a point where final adjustment is relatively simple. This doubtless saves more time in the long run than a trial adjustment method.

Results of the installation

As for the success with which the installation meets the standards of illumination control for which it was planned, the accompanying charts are a convincing indication. The daylight intensity distribution across typical rooms has the usual slope characteristics. The light on the inner row of desks has fallen below the 15-ft.-candle level even at 11 a.m. on a fair May day on the northwest exposure, and will naturally be frequently below this level at earlier hours even when the sun is shining outside. The fact that the inner row of lights were lighted under these conditions proved somewhat disturbing to some uninformed observers, who ascribed it to some weakness of the control system itself. It has been necessary to lay great stress on the fact that levels were selected in advance on the bases of authentic visual standards, that the control units merely *maintain* the selected levels—whether they be 5, 10 or 20 ft.-candles. Furthermore, it has been desirable to point out a fact which should seemingly be obvious, but ap-



Operation of steps 1 and 2, showing resulting illumination on rows 2, 4 and 6 in classroom (chart 2)

parently was not—that the control units, in themselves, are a negligible factor in energy consumption.

Chart 2 shows the distribution of artificial illumination with no daylight coming through the windows, indicating the reverse slope chosen for steps 1 and 2 to balance the daylight distribution.

Operation of the automatic control during a typical spring day (forenoon overcast, afternoon partly fair) is followed in chart 2, which shows intensity levels on three rows of desks throughout the school hours. At row 6 daylight alone was below 15 ft.-candles throughout the morning, but step 1 brought the lighting up to an adequate level. Total illumination on this row reached 30 ft.-candles at 1:30 p.m., and the lights automatically turned off. Step 2, operated in accordance with intensities on row 4, came into action for about an hour during the early forenoon, when daylight plus step 1 proved inadequate to keep the intensity above 15 ft.-candles. Although daylight remained the dominant illumination factor at row 2, even here variations were appreciably leveled out in the lower range of illumination levels where changes are most noticeable.

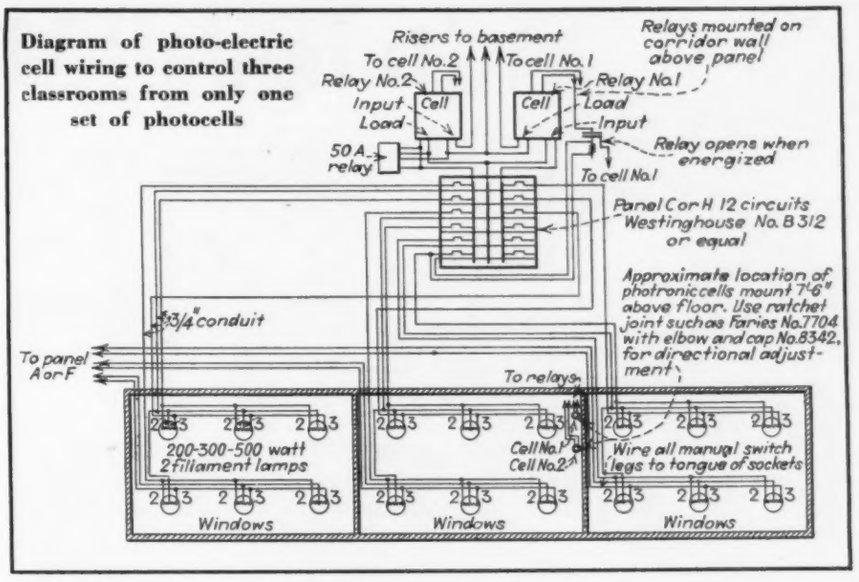
Proper use of window shades

A factor requiring considerable forethought, if the full benefits of illumination control are to be secured, centers around the use of window shades to reduce daylight glare. Their effects on the natural light reaching the interior rows of desks, as shown on chart 2, is such as to reduce illumination below adequate levels and bring step 1 again into operation. It is generally agreed that shades of the Venetian blind type are most effective in decreasing glaring peak levels near the windows without causing a proportionate decrease in light across the room. At the Highland school, however, other considerations made it necessary to use a type of window with which Venetian blinds could not be used. The problem was successfully solved, nevertheless, once the teachers were given a clear understanding of the matter. The shades are now drawn only to the extent required to eliminate glare, with the understanding that the operation of step 1 is a necessary and desirable aid to uniformity of illumination during this period.

As the rooms operated from a single pair of photocells have identical exposures, the period in which partially drawn shades are necessary also corresponds. Here, again, it should be emphasized that teachers and other individuals in a position to follow the operation of the control be given a thorough understanding of the fact that the photocells do not "decide" what is adequate lighting—but merely act to *maintain* a level which has been decided upon by their own superiors, whatever it may be. Otherwise, any reactionary attitude toward high lighting levels in general is unjustifiably directed at accuracy of the control.

At the Highland school practical confirmation of the desirability of the lighting levels selected and the control by which they are maintained was not sought in any comparative educational tests. The need for adequate standards of lighting was recognized as already proved beyond reasonable doubt. Automatic control was recognized as the only certain way to assure these standards on every desk, each hour of every school day, yet without a moment's waste from lights "left on." Frankly, these classroom lighting costs are higher than in other schools in Lynn, but only to the extent that the standards themselves are higher.

Diagram of photo-electric cell wiring to control three classrooms from only one set of photocells



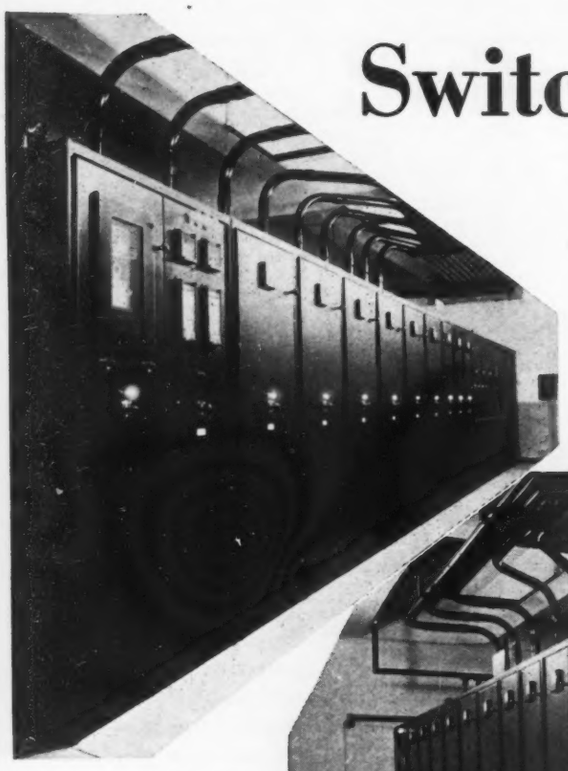
There is nothing particularly difficult or unusual, either for old schools or new, in assuring an *available* source of adequate illumination. However, the best lighting units in the world do not get to the heart of the problem—*proper utilization of artificial light sources* to maintain desirable illumination levels on every desk in day-after-day operation under varying conditions of daylight. A lighting system—like a heating system—can be no more effective than its control.

One example of the tangible benefits of these lighting standards is shown in the illustration of the first grade classroom. Here an informal seating arrangement—held to be definitely superior in its educational effectiveness for smaller children—was adopted without the slightest limitation from the standpoint of lighting. Yet in other schools throughout the country inadequate lighting has frequently made it impossible to benefit from such a change.

Automatic illumination control has been accused of being a new-fangled and unnecessary "frill." But look at the facts: The Highland school is air conditioned, it has a combination gymnasium and auditorium, facilities for sound motion picture projection equipment, a built-in radio speaker in every room. Probably no modern school of its size is now being built without one or more of these, if not all of them. Yet can any of them be justified more convincingly, on the basis of human health and happiness, than sight-saving lighting for every child?

Switchgear Modernized

Transformers and Pyranol Capacitors Also Installed in Order to Promote Production Efficiency in Vegetable Oil Plant



Heart of switchgear modernization at Edgewater, N.J., plant of Archer Daniels Midland Company. A new semi-flush cubicle board of shipped assembled type

Low-voltage end of new switchboard. Blank panels shown in foreground provide for future expansion

THROUGHOUT the entire industrial field the upward trend in general business conditions has made the need for modernization increasingly apparent. This discussion will review how the Archer Daniels Midland Company, in meeting the requirements of increased business, has provided greater assurance of continuous service by following a sound program of switchgear modernization at its Edgewater, N. J., plant. The new switchgear installation, recently completed, includes nineteen metal-inclosed cubicle units. In addition six large power transformers and four Pyranol-filled capacitor racks were installed to increase capacity and maintain power factor.

The Archer Daniels Midland Company manufactures vegetable oils and maintains plants in several locations in this country, the Edgewater plant being one of the largest. The processes of manufacture require that this plant be in continuous operation 24 hours a day the year around. Located on the Hudson River, the plant is accessible for the delivery of raw materials by boat. Shipments of between 5,000 and 9,000 tons of flax arrive at regular intervals and are unloaded direct from the hulls by suction developed by electrically driven compressors. The flax is then placed on electric conveyors, which transport it to the storage bins, in readiness for manufacture. In the manufacturing process electric service is required for the operation of conveyors, presses, kettles and in many other allied applications. Power is supplied by the Public Service Company of New Jersey from its 26,400-volt lines, stepped down successively through two series of transformer banks to 2,400 and 440 volts.

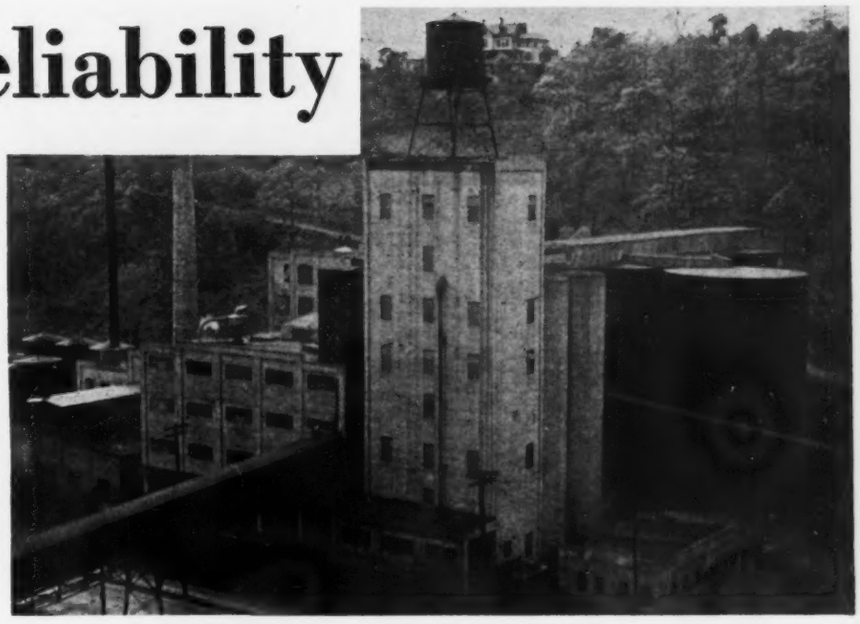
The total connected load of the plant is 6,308 hp., of which 2,267 hp. was connected to a revamped switchboard that had been originally installed in 1912 to distribute 350 kw. at 440 volts. At the time of the replacement this 24-year-old board was a vital key in the plant, serving twelve different departments. It extended across the entire end of one of the machine rooms, occupying valuable manufacturing floor space. Its panels were of the conventional live-front vertical type, of slate, with instruments, knife switches and fuses mounted on the front, exposing live parts. Mounted on the rear, oil circuit breakers, buses, connections and instrument transformers were also exposed to accidental contact, and there was no provision for isolating the oil circuit breakers from the bus.

Why new equipment was needed

Twenty-five years ago this was recognized as good practice, but as production schedules have become more exacting, and as continuous operation has become more necessary, switchgear designs have undergone vast improvements. The plant had outgrown the normal capacity and interrupting ratings of the oil circuit breakers and it was necessary that experienced electricians be available at all times to avoid complications. The old switchboard, revised to operate at increased capacity, was a constant threat to continous plant operation, which if interrupted would have represented a serious manufacturing loss and consequent delay in shipment. In addition, the fire insurance rates on the open type equipment placed an added burden on operating costs.

For several years records were kept on the cost of keeping this switchboard in operation, including new

for Plant Reliability



By WILLIAM A. FOLEY
Plant Superintendent,
Archer Daniels Midland Company,
Edgewater, N. J.

and

HAROLD C. PAIGE
Industrial Department,
General Electric Company,
Newark, N. J.

parts and labor required in maintenance. A careful analysis of these facts and the accurate record of maintenance costs dictated that the old switchboard should be replaced, for the sake of economy, with a new and up-to-date switching equipment. Incidental to the installation of the new switchgear, transformer capacity was increased by 50 per cent, a margin needed to safeguard the current production rate and to provide for future expansion.

New installation designed for flexibility

To meet the requirement of flexibility, the incoming and the various feeder equipments of the new switchboard were designed so that each is a separately inclosed unit. This localizes departmental shut-downs, as far as the control equipment is concerned, and provides safety to men working on the equipment. In order to reduce to a minimum the length of time required to effect the changeover, shipped assembled units of the cubical type manufactured by the General Electric Company were selected. A separate room adjoining the transformer vaults and the machine room was made available for the new board.

The new low-voltage switching equipment now occupies a space in the center of this room, approximately 41 ft. long, 6 ft. deep and 90 in. high. It consists of the following:

One 440-volt, three-phase, a. c. incoming line cubicle with 2,000-amp. oil circuit breakers.

Six 440-volt, three-phase, a. c. feeder cubicles with 1,200-amp. oil circuit breakers.

Three 440-volt, three-phase, a. c. feeder cubicles with 600-amp. oil circuit breakers.

Two 440-volt, three-phase, six-circuit, metal-inclosed air circuit breaker panels for auxiliary power.

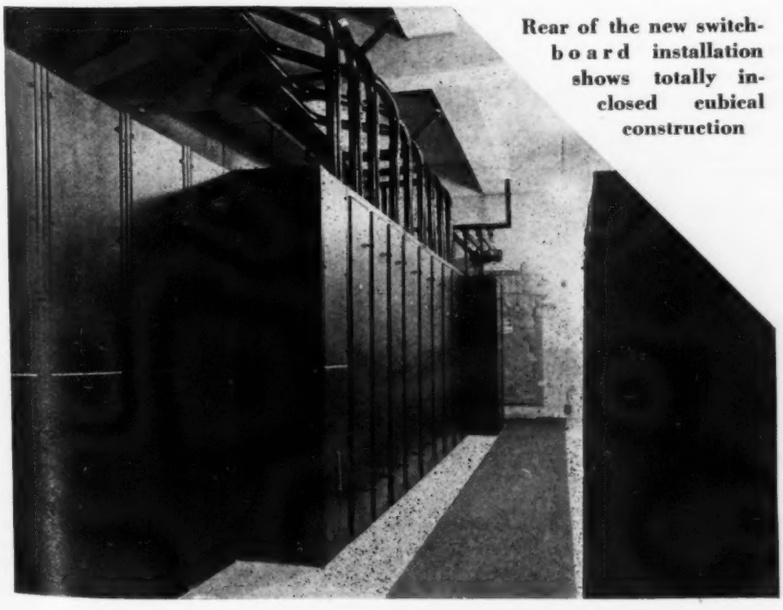
One 440-volt, three-phase, three-circuit, metal-inclosed air circuit breaker panel for feeding capacitors.

Two 250/115-volt, single-phase, three-wire, six-circuit, metal-inclosed air circuit breaker panels for lighting.

Two blank panels for future circuits and metering. The high-tension board consists of two 2,400-volt incoming line cubicles.

All instruments, meters and relays are of the semi-flush type, giving the front of the board smooth, regular contour. No live parts are exposed, and in each cubicle group-operated disconnecting switches are provided between the oil circuit breakers and the busbar. These disconnecting switches are mechanically interlocked with the oil circuit breakers and the hinged doors, so that access to the inside of each cubicle can be gained only when the disconnecting switches are open, and so that the disconnecting switches can be opened only after the breakers have been opened.

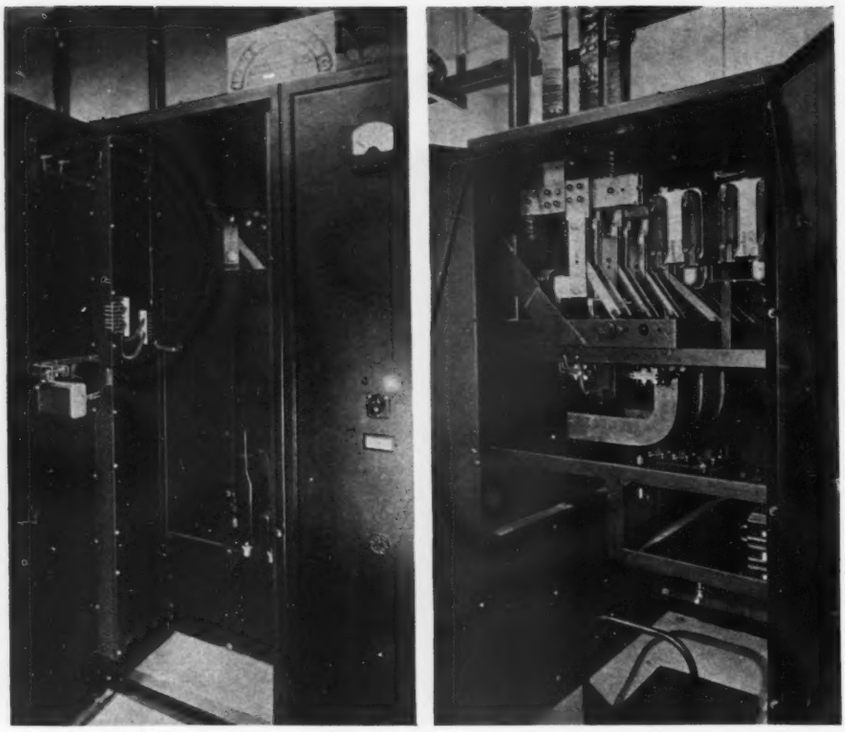
The 2,000- and 1,200-amp. oil circuit breakers have an interrupting capacity of 50,000 kva. and the 600-amp. breakers a capacity of 25,000 kva.



Rear of the new switchboard installation shows totally inclosed cubical construction

Complete changeover in 32 hours

One of the most interesting features of this installation was the speed with which the complete changeover from the old switchboard to the new was effected. At 8 p. m. on a Saturday the plant was shut down. At 4 a. m. the following Monday the transition was complete, with all connection perma-



Left—Open front of cubicle reveals window for observing position of disconnecting switches. Right—Open rear cubicle showing group-operated disconnecting switches

nent, and the plant resumed its regular operating schedule. It is significant that this rapid changeover was accomplished by the foreman, three electricians and three helpers of the regular plant electrical staff, without any emergency assistance. This fact commends the skill of the men who did the work and confirms the wisdom of the choice of shipped-assembled switchgear. To install equivalent switching equipment, not factory-assembled, would have required from two to three weeks.

Since the new switching equipment was installed there has been no question whatever of continuous plant operation, in so far as the supply of electric power to the various departments is concerned. Plant officials, electricians and workmen alike are now conscious of greater assurance that the plant will continue to operate uninterrupted, on its 24-hour-a-day basis. The installation is expected to realize a large saving in maintenance expense, figures for which are, of course, not yet available. In addition, all parts are easily accessible, yet safely protected by mechanical interlocks and metal inclosures—facts which have increased the safety of workmen and brought about a substantial reduction in accident insurance rates.

Another feature of the new installation is its ease of operation and the fine appearance. The switchboard room is now one of the show places of the plant.

Meets three basic requirements

Three physical requirements must be met in every industrial plant where continuous operation is an important factor. They are as follows:

1. A reliable power supply.
2. Adequate facilities for distributing power to machinery in the plant.
3. Dependable and efficient manufacturing machinery,

An unfailing suply of power from the lines of the Public Service Company of New Jersey meets the first requirement for the Archer Daniels Midland Company. A conservative expansion policy, with adequate provision for maintenance and replacement, has kept the company's equipment standards at a high level, thus satisfying the third requirement. Now, with a complete installation of modern switchgear to effect the reliable distribution of electric power throughout the plant, the company has met the second requirement and is in an admirable position to reap the benefits of continuous operation.

Street Lights Save Lives

An editorial from *Detroit News*, January 20, 1937

A question arises whether it is to take the city a year or five years to provide adequate illumination for downtown Detroit and fourteen main streets at night. The consideration debated is one of money: Whether the city ought to spread an outlay of $3,000,000 over the longer term, or take on the entire program at once, with a possibility of a substantial contribution from the W.P.A.

A government's first consideration is the safety of its people, and most of us will be disposed to agree with the Public Lighting Commission that the traffic fatality figures call for as much immediate action as the available money will support. If it is financially feasible, the full program should be started now.

The police offer comparative figures attesting the value of better lighting on traveled streets. Since September 1, not a fatality has occurred on three sections of street illumined in the new manner, where 40 night fatalities occurred in the preceding 2½ years. There is what amounts to a mathematical formula of what to expect in the way of decreased accidents as lighting is improved.

Better illumination is one of the phases of that engineering which we have long wished applied to the traffic problem. The figures show it to be the most influential on the accident rate. We cannot begin too soon to provide it on as many streets as our means allow.

That Old Test Meter Is Losing Money for You

Registration Errors in Uncompensated Standard Meters a Source of Loss in Testing New Service Meters

By ROYCE E. JOHNSON
School of Electrical Engineering, University of Wisconsin*

NOT many meter men are aware of the magnitude, in the aggregate, of the meter registration errors caused by the use of standard meters uncompensated for temperature errors, especially in testing new types of service meters. In order to find out how much various types of rotating standards were effected by temperature, refrigerating equipment was recently installed in the electrical standards laboratory of the University of Wisconsin and the Public Service Commission of Wisconsin.

Tests have been made on only a few meters, due to lack of time, but the results (although not enough meters have been tested to be positive), very definitely indicate that modern portable standard watt-hour meters are much better compensated for temperature errors than the old ones.

The potential coils were energized only while making the registration tests, since this procedure represents normal service. No attempt was made to get the meter registration in good adjustment before the temperature tests were made, because the relative changes with temperature will be practically independent of small errors in registration at normal temperature.

Results of the tests show why there is so much difficulty even in a constant temperature laboratory in adjusting some rotating standards to hold their registration within 0.1 per cent and why these meters in use are always found fast in the summer (on 100 per cent power factor loads) and slow in the cooler seasons.

To arrive at some idea of the cost of using these old rotating standards in testing both new service meters and old service meters installed in a fairly warm, constant temperature location, consider the accompanying table of weather temperatures for southern Wisconsin and estimated temperature of a rotating standard being carried from house to house. Lower temperatures would prevail farther north.

* From paper to Wisconsin Utilities Association.

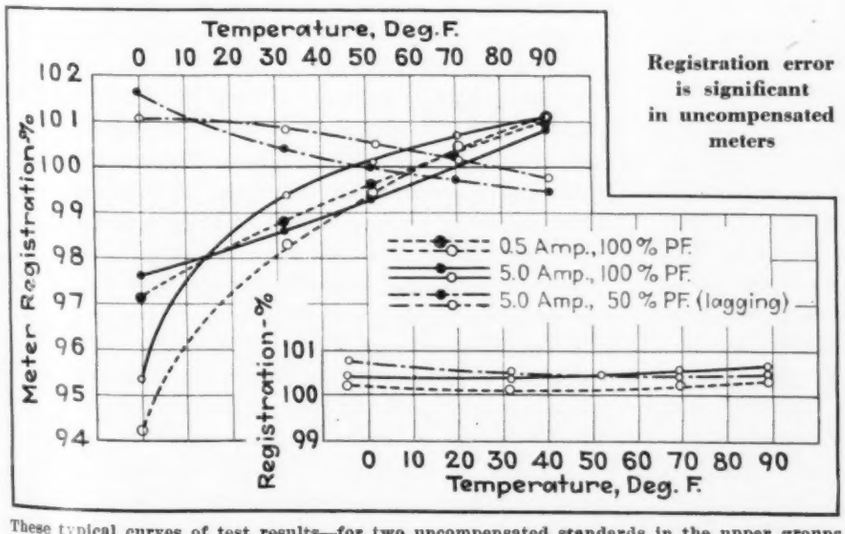
Typical Temperatures and Uncompensated Rotating Standard Errors

Month	Average Weather Temperature			Est. Rotating Standard Temp. Deg. F.	Approximate Meter Error 1% Slow)
	10 a.m.	3 p.m.	Ave.		
January	15.0	21.5	18.7	44	1.0
February	19.2	25.5	22.3	46	0.9
March	31.7	37.8	34.8	51	0.7
April	45.5	51.8	48.6	59	0.4
May	58.0	63.8	60.9	65	0.2
June	68.0	73.4	70.7	..	....
July	73.5	79.3	76.4	..	....
August	68.6	76.9	72.2	..	....
September	63.6	69.4	66.5	68	....
October	50.6	56.6	53.6	62	0.3
November	35.9	41.1	38.5	54	0.6
December	22.0	26.7	24.4	47	0.9
Average for eight months	....	....	....	..	0.625

Weather temperatures are averages for mid-morning and mid-afternoon hours for each month for the years from 1904 to 1930, furnished by the United States Weather Bureau. Temperature of the rotating standards is taken during cold months, as the average of the weather temperature and a room temperature of 70 deg. F. Very small errors will be found during the summer months because the standard meter temperature is nearly the same when used as when calibrated. For that reason no errors are given below for four months of the year.

If the losses due to using old rotating standard meters are to be estimated, it is necessary to know how many service meters are tested monthly which either are inside, where they do not get very cold, or which are of the temperature-compensated type. For convenience, we will assume that only 125 such constant temperature or compensated meters are tested monthly. Using an average monthly energy consumption of 60 kw.-hr. per customer, the losses in registration en-

[*Continued on page 139*]



Registration error is significant in uncompensated meters

These typical curves of test results—for two uncompensated standards in the upper groups and for one of the new temperature corrected instruments in the lower—show the large effect of temperature on registration of the older standard meters.

Editorials

HOWARD EHRLICH . EDITOR

Electric Bond & Share Decision Disappointing

THE limited scope of Judge Julian W. Mack's decision in the government's hand-picked case against Electric Bond & Share was disappointing. By limiting itself to the registration provision, the court left unanswered the constitutionality of the act as a whole, and particularly the famous "death sentence" provision.

Why the government, which, if we read correctly the President's latest message to Congress, is desirous of quickly determining the constitutionality of enacted laws, should want to limit judicial consideration in so important a case fails of understanding.

Can it be that the government by establishing the point of separability of the different parts of the act would be less fearful of the effect of a determination of any single provision, such as Section XI, upon the constitutionality of the act as a whole?

The Public Utility Act does not provide mandatory guidance for the S.E.C. to follow, but leaves such open to the arbitrary discrimination of the agency. It should be obvious that Judge Mack's decision opens the doors to unnecessary litigation on every S.E.C. order, a thing that we were led to believe in the beginning the government was trying to avoid.

•

Electrical Group Promotes New Mathematical Tool

WHILE few electrical engineers may know or even need to know what a tensor is or what it is good for, they should be appreciative of the fact that the electrical profession is participating in the formation of a new mathematical tool in such manner as to enlist the collaboration of abstract mathematicians. Several members of the Princeton, M.I.T. and other faculties attended the recent A.I.E.E. convention session to discuss the papers by Kron, Boyajian, Bewley and Pen-Tung Sah. Among them were Veblen, Hoffman, Lefschetz, Tucker, Struik, Burington and Byrne.

It is primarily Gabriel Kron who has shown that the tensor methods developed by the mathematicians to handle the complex problems of relativity and atomic theory have wide application in equally complex electric systems embracing machines and circuits. They are thus the most general technique known for expressing the relationships between any number of quantities, in space of any number of dimensions and with any degree of interdependence. While nomenclature and rigorous terminology are still to be clarified, as Slepian has pointed out, the abstract concepts can undoubtedly be evolved into workable technique even though the English counterpart lags.

New bonds of understanding between pure mathematicians and engineers are being formed in the process of forging and heat-treating this new tool of analysis, systematically and flexibly. P. L. Alger is to be commended for sponsoring and encouraging this symposium because it exemplifies the A.I.E.E. in its most erudite potentialties. It is quite possible that tensor analysis will ultimately provide the unifying influence for all engineering desired by many educators who are remolding curricula in efforts to consolidate the various branches into a more cohesive whole.

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The Problem of Sudden Prosperity

TRANSITION from a period of scarcity to a period of plenty brings with it certain very definite business problems. Today we are facing these problems in the electrical industry — the problems of sudden prosperity.

Orders are piling up, deliveries are becoming longer and prices are advancing. After several years with the buyer in the seat, we are in a seller's market. It is not an easy situation to handle.

When prices are falling the buyer has no pity, but should the seller take equal advantage in the upturn? In the electrical industry this situation can easily become serious. The power companies did for some time withhold equipment purchases for expansion and allow demand to absorb capacity reserve. This was not done through a spirit of penuriousness, but rather in caution, due in large measure to uncertainty as to the nature of the federal program of encroachment and restraint. Necessity, however, permits no delay.

Intelligent buyers realize that the period of very low prices has passed into history. They understand that basic materials and wages are up substantially, that operating and management costs, including the new taxes and the new clerical costs that go with them, have increased, and, naturally, they are prepared to pay higher prices.

On the other hand, the price situation might easily get out of hand and precipitate a flood of orders at protection prices, which, in turn, like 1921, would bring pyramids of orders, or false prosperity.

While the law of supply and demand has not been repealed in the new economic order, it is equally basic that a fair price maintains buyer confidence, helps

stabilize competition and enables the manufacturer to put the emphasis upon quality and service, where it really belongs, rather than on price. The buyer is still too close to the depression period, when price alone counted, to be willing to consider the life-time cost if the differential between products of different quality is considerable.

The fear today, not only in the electrical market but generally, is that this recovery market might gather momentum so fast that it will be uncontrollable and run away with itself. The electrical manufacturers are not unmindful of this situation.

Except for apparatus that of necessity takes a long time to build, forward-thinking manufacturers are not committing themselves to deliveries beyond a period in which they can protect themselves on raw materials and labor. To quote on longer deliveries means not only the possibility of loading the factory with orders that may be billed at prices considerably below the market at the time of delivery, but it creates the possibility of not being able to serve old customers.

The situation places upon buyers also certain definite responsibilities. Attempts to cover long-range requirements at present prices only accentuate the cluttered-up condition of the market and thereby contribute to higher prices. Buyers also can improve the delivery situation by confining their purchases as much as possible to standard equipment.

Sudden spurts and declines are not profitable for either the manufacturer or the utility. It is the long pull of slowly rising business that brings profits.

•

Poorly Lighted Federal Buildings

WHY are government buildings so poorly lighted? Here we have an administration that for four years preached "the more abundant life" through the wider use of electricity. Make electricity cheap enough, it has said, so that people will use lots of it.

In Washington, a city with extremely low rates, we have federal buildings erected in the past three years with lighting levels that would not have been acceptable by the conservative lighting standards of ten years ago. Lighting, the most universal use of electricity, is being skimped under the very administration that is urging the benefits of the wider use of electricity, the administration that is spending hundreds of millions of dollars in dams to make electricity more plentiful at lower rates, the administration that has all along insisted that low rates would bring higher energy consumption.

Surely the President is sincere in what he says about the benefits to be derived from the more extensive use of electricity and is not using electric energy as a political football to be kicked around. He must believe what he says about the relation of rates to the use of electricity. Then how does one account for the totally inadequate lighting of the new government buildings?

Like charity—which should begin at home—let the government start in Washington and build up the lighting in present and planned federal buildings to a level of intensity more nearly approaching the accepted standards, then perhaps it might speak with authority and experience when it tries to extend electric service far afield.

•

The Engineer as a Social Thinker

ATTEMPTS to apply the methods of engineering analysis to the complex problems of society, and thus by mathematical logic to arrive at their solutions, have not been frequent nor brilliant enough to make much impression on the public mind. This is why we see occasionally such expressions of the general feeling as was contained in President Roosevelt's recent letter to educators suggesting that undergraduate engineers be given an adequate conception of the social responsibilities that will be theirs when they go out in the world. But many of our best engineering and pedagogic minds have given long and serious thought to the problems of society.

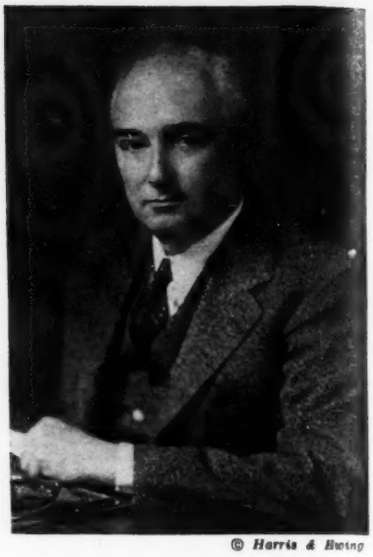
While the published results of these cogitations are comparatively few and quite uniformly lacking in those qualities of literary appeal that capture the public, they do contain much valuable material which might very readily lead to the common-sense resolution of many of the social and economic difficulties that beset us. Added now to the best among such works is the book 'The Capitalistic System and the Nature of Unemployment," by the late Alfred Alsaker, well-known electrical engineer, designer and inventor.

Radical in his youth, Alsaker did not, as do most of us, become conservative as he grew older by simple acceptance of things as they are. Although as a sensible man he accepted and enjoyed the rewards that capitalism gave him for his work, he did not believe in the rightness of the system—not until he had thought out the theory of the working of it, which is the material of his book. In his own words: "I conceived the idea of analyzing the general behavior of the capitalistic system by the methods commonly applied to engineering problems . . . I expected that an impartial analysis would prove the capitalistic system to be inherently unstable and detrimental to the workers' interests . . . My expectations were not fulfilled, however, and I was somewhat chagrined when my analysis showed that my former understanding of the capitalistic system was superficial and erroneous."

It will probably be the fate of Alfred Alsaker's book to be neglected by men in positions of power. And they will continue their well- or ill-judged experimenting with the lives of men in preference to taking a reasoned analysis of the facts and conditions of civilized society as the starting point for logical and intelligent treatment of them.

Roosevelt Favors Lilienthal on T.V.A.

By CARTER FIELD



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This noted journalist gives his personal comments and interpretations on current happenings affecting the electrical industry. His background and his location at Washington make his thoughts informative and interesting even though all may not agree with him.

WASHINGTON chuckles over an alleged bedtime story about President and Mrs. Roosevelt. Said Eleanor, according to the tale: "Franklin, I just don't understand you. Last night at dinner you listened to Senator A expound his doctrine and you said to him: 'Senator A, you are perfectly right.' But tonight at dinner you listened to Senator B say exactly the opposite, and you said to him: 'Senator B, you are perfectly right.' I just don't see how you can be like that."

"Eleanor," the President is alleged to have replied, with considerable emphasis, "you are perfectly right."

Which is one explanation of why nobody in Washington is quite sure whether Dr. Arthur E. Morgan or David E. Lilienthal is going to win the T.V.A. battle now in progress.

Lilienthal emerged from a talk with the President saying: "I got what I came after."

Morgan talked an hour and a half with the President later and came out almost convinced again that the President was fundamentally on his side —*almost!*

But there are some very potent gentlemen who have no doubt whatever about the outcome. For exemple, Senators George W. Norris, daddy of T.V.A.; Senator Robert La Follette, of Lilienthal's home state of Wisconsin; Senator Homer T. Bone of Washington. They are for Lilienthal, personally, politically and economically.

They want the entire electric industry of this country in the hands of the government, and they are not greatly concerned over any such constitutional questions as taking property without due process of law. Besides, aren't we going to fix up the judiciary?

Every indication is that the President is leaning distinctly toward the Lilienthal side. Not all the way, but a considerable portion of it.

It is perfectly true that the President is interested in Dr. Morgan's ideas about T.V.A. outside of power —river control, irrigation, social experiment, economic planning, etc. But these do not present, for the moment at least, a battle—certainly not a battle against a cordially detested enemy! And how Roosevelt does revel in a battle!

Arthur Morgan holds views which are anathema both to the radicals and conservatives in this fight. But he has been hamstrung from the beginning. At the outset, back in 1933, Lilienthal and Harcourt A. Morgan, the third member of the authority, made a "voting trust" agreement. Lilienthal would vote for everything H. A. wanted on questions affecting agriculture, and in return H.A. would vote for everything Lilienthal wanted on power!

Lilienthal has wanted battle and competition to the bitter end from the first, and every vote in T.V.A. has been decided two to one in his favor. One of the first decisions was that Lilienthal should handle all the negotiations with the private utilities. In the recent case Dr. Morgan insisted that Wendell Willkie of Commonwealth & Southern should come before the entire board with his proposition. Lilienthal agreed reluctantly to this, but then advised Willkie privately that the need for his appearance had passed!

Willkie smelled a mouse and came anyhow. Asked if his views were correctly stated in writing by Lilienthal, he emphatically denied that they were. But within a few minutes after the adjournment of the conference a statement was issued from T.V.A. headquarters in Washington stating Willkie's views as Lilienthal had expressed them. And this happened after a request by Willkie for a joint statement had been voted down by the customary two to one vote!

President Roosevelt told both Morgan and Lilienthal that he wanted the contract between T.V.A. and Commonwealth & Southern extended for a brief period pending negotiations. But Lilienthal, always with the two to one vote power over the chairman, wrote in terms and conditions which he is accused of suspecting Commonwealth & Southern would not accept.

That's the way the battle has been going, with Lilienthal appealing to local pride, local industry and labor, and with those in sympathy with him running a sniping campaign in addition to the main objective.

One might well wonder why the President does not just throw Dr. Morgan out. There are three reasons why he has not done so. First, the President likes Dr. Morgan personally, and has a personal and very strong reluctance ever to throw anyone out about whose personal loyalty there is no question. Second, the President actually goes a long way toward agreement with Dr. Morgan's economic theories with respect to the electric business. And, finally, Dr. Morgan has a mass of documents accumulated since 1933 which might be highly embarrassing to the Administration if published, though nothing that reflects in the slightest degree on the President himself.

One of the attacks on Dr. Morgan is that he has always favored the pri-

[*Continued on page* 134]

Letters TO THE EDITOR

"To Sell Commercial Cooking"

To the Editor of ELECTRICAL WORLD:

I was very much interested in your editorial "The Key to Commercial Cooking," in the September 26 issue. Having served as chairman of the N.E.L.A. commercial cooking committee for several years prior to its being discontinued, I was asked to act in the interest of the electric commercial cooking market as a member of the industrial power subcommittee, later organized under the E.E.I.

It is quite true that as an industry we attempted to develop this market by talking about electricity to people who thought in terms of food. However, it should be pointed out that during the years 1928 through 1931 national commercial cooking schools were held under the auspices of N.E.L.A., at which prominent chefs and managers from the food service industry appeared to instruct our power company salesmen in the terminology and technique of kitchen operation. It is my personal conviction that the peak sales in this market, attained in 1930, were due to the start we had made in this type of instruction, together with efforts to co-ordinate the interest of equipment manufacturers, utilities and consumers through their trade associations.

Utility sales departments that have continued to develop this market during the past five years have turned to the sale of small counter devices with more success than appears on the surface. Today more than 65 per cent of the financially responsible restaurants in the country use electricity for specialty cooking with these small devices, and this number will increase materially this year. Thus, the chef and kitchen manager have become acquainted with the "opening wedge" to electric cooking. These chefs and managers will continue to buy small electrical devices.

The complete kitchen installation must rest with the hotel or restaurant owner and in many cases the banker who may be concerned with the financial aspects of business.

Over-all cooking cost, in the mind of this man at the top, is an expense item averaging from 1.5 to 2 per cent of gross sales cost, regardless of fuel. He is much more concerned with food cost, which represents 42 per cent, and labor cost at 24 per cent, both of which are increasing. When the utilities and manufacturers co-ordinate their efforts and hire kitchen experts who in turn can show the food service executive that electric equipment can save food and labor cost, this market will assume a major position in utility sales.

At present the commercial kitchens of the country are filled with obsolete equipment, but the cooking fuel is not the key to opening this market. The key lies in some modern medium that will cut food and labor costs, save space, step up efficiency, improve quality, which, at present, only electric equipment can do. The key is held by some kitchen expert who knows these facts and can profit by presenting them forcefully. He will be the vital factor in the Commercial Cooking Bureau that will eventually come into its own as the stepchild of the successful marketing bureaus that have already lighted the way.

B. M. RIKER,
Manager Commercial Dept.,
Rockland Light & Power Co.

To the Editor of ELECTRICAL WORLD:

Please permit me to express my personal appreciation of your recent editorial on "The Key to Commercial Cooking."

Ten years back it was my privilege to be chairman of the commercial cooking committee, N.E.L.A., and know some of the reasons why electric commercial cooking and baking have not been the success they so well deserve. It was not the selling of electric cooking devices that failed, however. The greatest obstacle was and still is the failure of the utility executive to become electric cooking minded.

We had, and have, in our industry, many very capable and experienced cooking salesmen and engineers. But we lack executive acceptance, and with little or no advertising of the product, selling is almost impossible.

Wiring and installation costs are also altogether too high and nobody has ever done anything about it. In many cases, too, the rate has impeded sales effort, especially in instances where a maximum demand was in the schedule.

The commercial cooking committee did get out real information and held successful cooking schools. Attendants received training that put them in position to sell hotel and restaurant managers and chefs. Most of this information we secured from practical experience not learned from books. There have been more than a hundred articles written by our salesmen on electric cooking, most of which I have in my files. These have been placed in the hands of hotel men. Hotel and restaurant executives knew more about electric cooking than one would suppose. They are all very well read and are up to date—they are paid for that.

We were just beginning to come into our own when the old N.E.L.A. folded up. What we need is the reorganization of the old committee work, supported by more advertising, lower rates and wiring costs.

A. M. LLOYD,
Sales Engineer, Electric Cooking,
Commonwealth Edison Company, Chicago

Doubts Necessity for Heavy Rural Design

To the Editor of ELECTRICAL WORLD:

I believe that G. H. Underhill has presented a very timely discussion on the dubious propriety of retaining heavy-loading design for rural lines. As I recall it, this is the first feature article in the ELECTRICAL WORLD that has been devoted to this important subject.

In my letter to the editor in the July 28, 1934, issue I wrote: "In view of the great difference between the code requirements and the probable extreme weather conditions, it seems that this offers at present one of the most promising fields for investigation for reducing this so-called 'irreducible minimum of the distribution outlay.'"

In a graduate research project, sponsored jointly by a large electric utility and the college, a special study was made of this particular problem. A mathematical study, using probability theory, of a 40-year Weather Bureau record at a given location showed that the heavy loading would occur only once in thousands of years, providing, of course, there would not be a definite long-term climatic change trend. A new loading, that would take place only once in hundreds of years, was proposed.

When this new proposed loading was applied to the design of a two-wire, 6,900-volt rural line a saving of 20.6 per cent was indicated in the first cost. A line of this type was actually built at a later date, and the savings were a little larger than expected. The operation of this line has been so satisfactory that numerous additional ones have been built, and the savings have become progressively larger.

The details of this study are discussed by B. E. Lowe in Oklahoma Agricultural and Mechanical College Engineering Experiment Station Publication No. 20, "Rural Line Design Investigations."

A. NAETER,
Head of Electrical Eng. Dept.,
Oklahoma Agricultural and Mechanical College, Stillwater.

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Likes the Inquiry Cards

To the Editor of ELECTRICAL WORLD:

I should like to take this opportunity of congratulating you on your excellent magazine, which is read with great interest both by myself and my staff. The [manufacturers' bulletin] card is an excellent idea and the information will be valuable.

E. S. DUNCH,
Bermuda Electric Light, Power & Traction Co., Hamilton

News OF THE WEEK

Proposed Judiciary Change Seen Giving Roosevelt a Strong Hand

Reform on injunctions would provide bargaining weapon in settlement of the T.V.A. situation — Resumption of negotiations likely when hostile group has talked itself out — Await policy report

Action last week by President Roosevelt in recommending to Congress sweeping changes in the judiciary is seen by close observers as a move to give him the upper hand in power and other controversies now receiving consideration. A bitter fight is expected in Congress when the proposed reorganization plan reaches the floor. Charges have been made that the President was attempting to "pack" the bench so as to insure rulings on New Deal legislation to his liking.

The nearness of the decision of Federal Judge Julian W. Mack, in the government's "hand-picked" case against Electric Bond & Share and twenty-one affiliates, to the President's message had the appearance that Mr. Roosevelt desired a change in the Supreme Court personnel before the utility suit reached it. Judge Mack's decision upheld the government's contention that the provisions of the utility act are separable.

The references to the injunctive processes of the courts by Mr. Roosevelt is regarded as a step to give him a weapon to use, in bargaining, against those contesting New Deal legislation. This is particularly true in the T.V.A.-utility power pool controversy. It is well known that the President is not entirely satisfied with the present power situation. The injunction against the T.V.A. has "frozen" that agency and given the utilities a strong weapon to be used in bargaining for a solution of the difficult problem. Opinion prevails in Washington that Mr. Roosevelt still desires to settle the power question in fairness to all. It is understood that an advisory group is considering the federal power policy independently of the Ickes committee. This has been interpreted to mean that Mr. Roosevelt will not rely entirely upon the opinion of those known to favor government ownership.

The argument has also been put forth in Washington circles that the President has paved the way for the power "radicals" to talk themselves out and to give him the time to win them over to his views. It was pointed out that certainly the outbursts by Senator George W. Norris and Representatives John E. Rankin against any compromise between T.V.A. and the utilities has made it difficult for Mr. Roosevelt. Their charges against the utilities take on the atmosphere of arousing an unwarranted atmosphere of public antagonism.

Feeling is still strong in informed quarters that when the government has maneuvered itself into a more favorable bargaining position, and the controversial aspects thoroughly aired, Mr. Roosevelt will force a solution which will protect private utility investment and at the same time carry out his original intentions of cheap and abundant electricity.

Two Utilities Withdraw Suits, to File with S.E.C. Under Act

After fourteen months of bitter opposition to the Public Utility Holding Company Act and emphasizing the destructive features of the legslation and possible losses to investors, North American Company and American Water Works & Electric Company capitulated to the demands of the Securities and Exchange Commission and this week signified their intentions of registering under the Act.

The action of the two utilities came suddenly and as a complete surprise as it had been held that their cases, recently remanded back to the lower court by the Supreme Court, offered a splendid opportunity for a complete test of the constitutionality of the Utility Act. The intention to regster follows closely the decision of Federal Judge Julian W. Mack on January 29 upholding the Government's contention that the sections of the Act are separable and the validity of the registration provisions.

James M. Landis, chairman of the S.E.C., was highly elated over the action of the two utilities and in a letter to James F. Fogarty, president of North American, stated that "the pursuit of such a policy means not only increased emphasis upon respect for law and law observance—so important in these days of financial and economic readjustment—but prevents the possibility of irretrievable harm being done to those moral sanctions upon which one must ultmately rely for the appropriate effectuation of broad government policy."

Not only are the two companies registering but they are withdrawing their

suits in the District of Columbia Court to enjoin enforcement of the Act. However, in registering they are reserving constitutional rights to contest later any provsion of the Act.

The companes stated that they favored constructive regulation of holding companies and thought that by registering legal clarification of the situation could be effected.

Amercan Water Works & Electric expects to proceed promptly with plans for simplification of its capital structure and for extensive refinancing, H. Hobart Porter, president, declared.

Electric Bond & Share has not signified what course it will follow, but belief is strong that the company may register as may some of the other utility companies.

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Merger Application Denied by Board

Application of Lexington Water Power Company and Broad River Power Company of Columbia, S. C., subsidiaries of the Associated Gas & Electric System, for authority to merge has been denied by the South Carolina Public Service Commission. The commission held that comparing the income and indebtedness of the two companies it was obvious that the Broad River's revenues are much larger in relation to its funded debt than the Lexington Company's.

Power Production by Electric Utilities Reaches All-Time Peak

Sales to ultimate consumers show increase of 15.3 per cent, while revenue is up only 7.7 per cent — Average residential use is 719 kw.-hr., with rate at 4.69 cents — Industry pays $266,000,000 in all taxes

Generation of electricity by the electric light and power industry for 1936 was the highest in history, totaling 106,000,000,000 kw., and compares with 92,611,423,000 kw. in the preceding year, a gain of 14.5 per cent, according to the Edison Electric Institute. Kilowatt-hour sales to ultimate consumers totaled 89,500,000,000, against 77,596,025,000 in 1935, an increase of 15.3 per cent. Revenue from ultimate consumers was $2,058,300,000, against $1,911,988,900, a gain of 7.7 per cent.

Net purchases higher

Kilowatt-hour generation by water power was 37,000,000,000, against 36,543,567,000 in 1935, a gain of 1.2 per cent. Steam generation showed an increase of 23.4 per cent—68,100,000,000, against 55,197,445,000. Kilowatt-hour net purchases from other sources was 2,000,000,000, against 2,351,360,000 in 1935, and net purchases over international boundaries was 1,000,000,000, against 901,098,000.

Generating capacity at the end of 1936 was estimated as 34,076,000 kw., of which 9,410,000, or 28 per cent, was in water power stations, 24,026,000 in steam station and 640,000 in internal combustion engine plants. This compares with 38,888,305 kw. in 1935.

Total construction expenditures for 1936 were estimated by the institute at $275,000,000, as against $192,000,000 the year before and less than one-third of the peak 1930 figure of $919,000,000.

It was estimated that as a result of promotional sales campaigns electrical appliance dealers, other than the utilities, sold more than $452,000,000 of merchandise during last year, which was 85 per cent of the total of such sales. During the first eleven months of 1936 more than 1,956,327 electric refrigerators were sold, and it is estimated that practically 90 per cent were sold through non-utility outlets.

More than 26,100,000 customers are now receiving electric service, as against 25,312,802 at the end of 1935, an increase of 3.1 per cent. It is

REVENUE FOR RURAL LINES—Part of the group of 300 from Southern utility companies who attended the Southeastern Regional Farm Power Sales Conference at Atlanta, Ga. During the two-day conference major attention was focussed on the manifold uses of electric service on the farm, and twenty speakers, from utility companies and electrical manufacturing groups, discussed methods for securing revenue from rural lines.

estimated that 915,000 farms are now receiving electric service.

Taxes higher

The institute estimates that the electric utilities paid $266,000,000 in taxes, an increase of $11,000,000 over the total taxes in 1935. Federal taxes amounted to about one-third of the total. Taxes paid by privately owned electric utilities represent an amount twice the cost of fuel and three-fourths of the annual payroll, it was said.

Residential electric rates showed a decrease of 6 per cent and the unit cost was 46 per cent below 1913, while the cost of living was 44 per cent above the 1913 figure. The annual residential use per customer in 1936 was 719 kw.-hr., as against 669 kw.-hr. the year before. The average rate was 4.69 cents, against 4.99 cents. The average annual bill was $33.72, against $33.38 in 1935.

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Long Island Utility Drops Rate Contest

The Long Island Lighting Company has decided not to appeal the recent decision of the Appellate Division of the Supreme Court, supporting orders of the Public Service Commission lowering electricity rates of the company.

The Long Island Lighting Company sought by certiorari to review the determination of the commission, which had directed a cut in rates which would cost the company $1,194,000 a year. The company voluntarily made a reduction of $553,000, but the commission ordered a further cut of $641,000. The decision means the company must refund more than $640,000 in rate rebates to customers, plus 6 per cent interest.

•

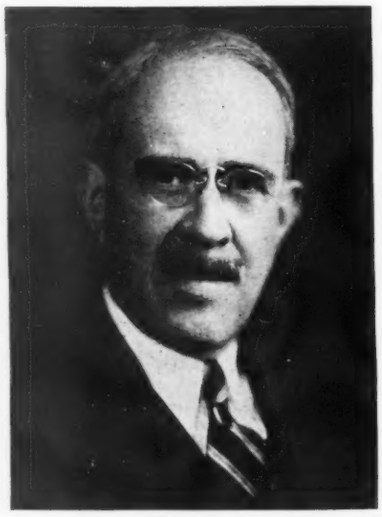
Utility Not Responsible for Service Pipe Failure

Owners of dwellings and not power companies are responsible for service entrance conduits run down the side of the house, the Massachusetts Department of Public Utilities ruled in a recent finding. A. W. Withey petitioned the board to order the Lynn Gas & Electric Company to meet the cost of replacing a service pipe of this kind which was torn from its moorings when a tree fell across wires of the company.

Morris L. Cooke Quits as Power Board Director for Trip Abroad

Resignation as head of Rural Electrification Administration accepted "with the greatest reluctance" by President Roosevelt — Regarded as one of most influential advisers in formulation of policies on power

Morris L. Cooke, who has headed the Rural Electrification Administration since its inception in May, 1935, has resigned in order to take an extended trip abroad. Although it was known that Mr. Cooke, who is 64 years old, has several times requested to be relieved of his duties, first notice that his resignation was being given serious consideration came with a White House announcement February 6, releasing him "with the greatest reluctance." Mr. Cooke now joins the coterie of New Deal policy makers who have retired to private life since the re-election of President Roosevelt last fall.



Morris Llewellyn Cooke

The views of Mr. Cooke on power development and conservation have been influential in shaping Mr. Roosevelt's policy, even before he became President. Mr. Cooke served as a member of the New York State Power Authority by appointment of Mr. Roosevelt when he was Governor of New York. He became Administrator of the R.E.A. when it was formed, having previously been with the National Resources Board. He was principally responsible for the Mississippi Valley report issued by the board.

Giving a strictly personal reason for wanting to retire from public life, Mr. Cooke wrote the following letter to President Roosevelt:

DEAR MR. ROOSEVELT:

In accordance with our conversation, this is to ask you to accept my resignation as administrator of the Rural Electrification Administration as of about February 15. As you know, Mrs. Cooke and I are planning to go on an extended trip out of the country. The R.E.A. is now a seasoned organization and fully competent to carry on along lines you, Mr. Roosevelt, have sponsored from the beginning.

I believe so thoroughly in what is being accomplished that this association with your Administration has been a heartening experience. And for the solid satisfaction which I have gotten out of my various assignments and for the inspiration of your support and far-sighted leadership, I shall always be deeply grateful. Very sincerely yours,

MORRIS L. COOKE.

The President's reply

The President accepted Mr. Cooke's resignation in the following letter:

MY DEAR MORRIS:

It is with the greatest reluctance that I accede to your request and accept your resignation.

Were it not for the fact that I know so well your personal reasons for asking to be relieved, I would make another appeal to you to stay.

There is no need for me to tell you how sincerely I appreciate your fine loyalty and contribution.

Remember you promised to get in touch with me just as soon as you and Mrs. Cooke get back. I hope that you get a much-needed rest and that you have a grand trip. Very sincerely yours,

FRANKLIN D. ROOSEVELT.

Pending the appointment of a successor, administration of R.E.A. will be in the hands of John M. Carmody, who was appointed assistant administrator last August and has been responsible for much of the detailed work of the agency. This relieved Mr. Cooke for his study of the drought area and, more recently, to take up his duties with the Ickes power group.

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New Substations Planned

Construction of a substation at Middletown at a cost of $300,000 and a similar station at Stamford to cost $250,000 are planned this year, according to a recent statement by V. E. Bird, president Connecticut Power Company.

Federal Power Aims Not Likely to Be Altered by Policy Report

Recommendations for Bonneville Dam by Ickes committee will apply to all government hydro-electric projects — President with blanket authority can designate agency to operate plants and to fix rates

Despite its limitation to the specific problem at Bonneville on the Columbia River, study of the first report of the President's newest power policy committee should shed considerable light upon the future course of the Administration in distributing its surplus kilowatts.

Conditions in the Pacific Northwest, while by no means identical with those at Fort Peck or in the Tennessee Valley, follow a general pattern of sufficient similarity to justify a conclusion that the answer in one case will not vary greatly from the solution in the others. Furthermore, the fact that the same committee intends to progress from the specific, at Bonneville, to the general, covering federal marketing policies for all projects with "incidental" power to dispose of, is a safe indication that the two will not be found incompatible.

Propose bill

Unless all signs fail a pre-view of the committee's recommendations for Bonneville was given during the closing days of the last session when the Oregon and Washington senators, awakening to the fact that power production would start late in 1937, unsuccessfully attempted to crowd through a bill providing for a permanent administrative set-up that had, very significantly, the indorsement of the Corps of Engineers, the Federal Power Commission and of Franklin D. Roosevelt.

As regards Bonneville, this placed administration, operation and maintenance in the hands of the Corps of Engineers, but gave to the Federal Power Commission full determination over the rates to be charged. It provided that power should be sold at wholesale preferably to states, local governments and non-profit co-operatives, with the surplus over these demands, if any, available to private power companies for resale. It gave to the government full power of eminent domain to acquire personal or real property needed for transmission purposes, including existing transmission facilities.

With the immediate problem thus taken care of, the bill proceeded to extend these principles to all federal projects producing surplus power or expected to do so in the future, giving the President blanket authority to designate, in the absence of statutory commitments, any existing agency to develop and sell such power at rates to be determined by the Federal Power Commission.

In setting rates the commission was directed to give consideration to (1) costs which it believed properly chargeable to power; (2) the interest of the ultimate consumer; (3) the general public welfare; (4) available markets.

This was the Administration's power policy three months before the fruitless "truce" with the utility industry, and there is no reason to doubt that this is substantially its policy at the present time.

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Hold Joint Hearing on Associated Gas

The Federal Power Commission, sitting jointly with the Pennsylvania Public Service Commission, will hold a hearing on March 3, in Washington to "ascertain and determine all facts, conditions, practices and matters regarding the ownership, operation, management and control" of the numerous servicing companies in the Associated Gas & Electric System.

Chairman Frank R. McNinch said that this is the first hearing in which the Federal Power Commission is exercising authority given by the Federal Power Act to hold joint hearings with state commissions on matters of mutual interest. The request for such a hearing was made by the Pennsylvania commission.

The investigation was begun in January, 1936, and related to charges reflected on the books of six operating companies of Associated Gas & Electric, including Metropolitan Edison, Northern Pennsylvania Power, Pennsylvania Electric, Erie Lighting, Clarion River Power and Solar Electric companies.

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Utility Common Par Reductions Approved

S.E.C. has issued orders declaring effective as of February 4 declarations filed by American Public Service Company and Central and South West Utilities Company.

American Public Service's declaration concerned reducing common par value to $80 per share from $100, reducing capital to $7,714,720 from $9,644,708 and issuing 96,434 shares of common stock, $80 par value, in exchange for a like amount of present $100 par shares.

Central and South West Utilities Company's declaration concerned reducing common par value to 50 cents per share from $1 and reducing capital to $1,686,368 from $24,229,757.

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Commission Orders Filing of Legal Fees

Utilities in New York State have been ordered by the Public Service Commission to file at its office in Albany, by not later than February 28, a statement showing amounts paid or liabilities incurred for legal services and for services and expenses of attorneys for the past six years.

The sweeping investigation of the legal fees paid is believed to have been instituted by the commission to determine the amount spent in fighting rate reduction orders, opposing the enactment of utility legislation and opposing the order for a uniform system of accounts. The period covers January 1, 1931, to December 31, 1936.

•

Court Restrains City Plant From Selling Appliances

The Supreme Court of Massachusetts has ruled that the municipal lighting plant at Concord has no authority to sell electrical appliances under the general law establishing such plants and providing for their operation. The case was brought by electrical contractor-dealers and fourteen other petitioners. Chief Justice Ruggs' opinion holds that the conten-

tion cannot be supported that since private companies conduct this retail business as an adjunct to the business of supplying electricity a municipality has equal power to do so.

The Town Department claimed that in four years the revenue had been increased by $31,221 as a result of maintaining its electric appliance store through the sale of 128 refrigerators, 115 electric ranges, 49 water heaters and other appliances.

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Duquesne Light Plans Budget of $12,000,000

More than $12,000,000 is expected to be spent by the Duquesne Light Company on a construction and improvement program beginning within the next few weeks and largely completed this year. The principal expenditures under the proposed budget will be made to correct some of the weaker spots in Duquesne Light's power-producing and distributing system uncovered in the flood of last year. The present flood, while not so severe here as that of 1936, also has put a severe strain on the system.

Frank R. Phillips, president, declared that the company finds an increase in its facilities necessary to take care of an anticipated increased use of electric power over the next year or two. New power units are to be constructed for both industrial and domestic users.

Recent offers by the company to reduce power rates for commercial users by approximately $500,000 a year were rejected by the Pennsylvania Public Service Commission, which demanded that the reductions in rates be made applicable to domestic instead of commercial consumers. A new schedule has been filed.

•

Bathurst Power & Paper to Increase Facilities

Bathurst Power & Paper Co., Ltd., is proceeding with a program of improvements to round out the production facilities of its pulp and paper plant and to enable the company to take care of increasing business, according to R. L. Weldon, president.

Expendtures of $650,000 are involved, and it is expected that the work will be completed by August. Orders for a portion of the major equipment have already been placed.

Standard Gas Unit to Spend $8,142,000

Northern States Power doubles 1936 expenditures to add generating units and build new lines

Northern States Power Company estimates construction and improvement expenditures will total more than $8,142,000 this year, more than double the 1936 total, according to Robert F. Pack, president. Every division of the company, Minnesota, Wisconsin and South Dakota, is included in the expansion and betterment program.

The largest single item will be expansion of the large Riverside steam station in Minneapolis. A new generating unit will be added, increasing capacity of the plant by 46,700 hp., to 180,000, making it the largest electrical plant in the Northwest. Two additional boilers also will be installed.

Other Minneapolis developments will include an additional service line between Riverside and the downtown Minneapolis district, improvements at the Hiawatha substation and the Main Street northeast generating station, and a new 13,000-volt line between the Wilson and Zenith substations.

In St. Paul a new substation will be built to serve the growing St. Anthony Hill district, additional booster capacity will be installed at the Olive gas station and funds are set aside to finance additional gas service.

An additional 4,000-hp. generating unit will be installed at Grand Forks, with new boilers to supply steam. Fargo and Minot divisions will have more funds to handle new business.

In the Faribault and Mankato, Minn., divisions a number of lines will be rebuilt and some voltages will be increased to handle larger loads. In the St. Cloud, Minn., division the substation at Belgrade will be rebuilt and new and more powerful lines substituted for present lines.

Lines will be rebuilt and substations improved in the Sioux Falls, Southwestern and Wisconsin divisions. In all districts Northern States is providing for increased electric service to farms.

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Electric Sales in Illinois

Total sales of electricity to ultimate consumers in Illinois for 1936, as reported by twelve large companies doing over 98 per cent of the electric business, were 6,528,083,106 kw.-hr., as against 5,767,425,251 kw.-hr. for 1935. The largest gains in sales were made by the companies operating outside of Chicago; total sales were 19.8 per cent above 1935. Sales in December showed a gain of 12.4 per cent.

•

Wiring Design Group to Be Permanent Body

At its first annual meeting in New York on January 28 the Industry Committee on Interior Wiring Design organized as a permanent body with E. A. Brand, Niagara Hudson Power Corporation, Buffalo, as chairman. Other officers are Allan Coggeshall, Hatzel & Buehler, New York, vice-chairman, and R. G. Slauer, Westinghouse Lamp Company, Bloomfield, N. J., secretary. Each of the groups sponsoring this committee will have two members on the committee with the privilege of additional advisory members.

The purpose of this committee is the furtherance of adequate wiring through the preparation and distribution of the Handbook on Wiring Design, which is scheduled to come off the press week after next. This handbook, which will be 80 pages in size, will have a 10,000 printing for the first edition. It will carry a price of $1 for single copies, with a scaling down to 20 cents for larger quantities. Books will be available at the offices of any of the sponsoring associations or at the committee headquarters, 2650 Graybar Building, New York City.

In order to promote book usage and to keep it in tune with local practice the committee is setting up a group to make suggestions for a permanent activity covering both of these problems.

Among the sponsor bodies are the national associations representing the electric utilities, manufacturers, contractors, wholesalers and inspectors.

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Wiring Ordinance Upheld

An attack on the Atlanta, Ga., city ordinance providing for approval of electrical wiring and the licensing of electrical contractors failed when the Supreme Court of the state reversed a decision of Judge G. H. Howard, in the Fulton Superior Court, and dissolved an injunction against the city and the city electrician.

Wisconsin Utilities to Spend $15,347,678

Utilities in Wisconsin this year will spend approximately $15,347,678 for construction and maintenance purposes, an increase of more than $2,000,000 over 1936, according to a survey made by the Wisconsin Utilities Association.

Electric utilities constructed 2,333 miles of rural lines during 1936, according to A. F. Herwig, secretary of the association, bringing service to 6,002 customers.

Twenty electric, gas and transportation companies last year paid $10,026,384 in state and local taxes, against $9,965,043 in 1935. Their total payroll amounted to $19,873,015 for 12,062 employees, an increase of $1,500,000 over 1935.

At the beginning of 1937 electric utilities served 613,120 customers, against 594,000 in 1935, and sold 3,333,481,747 kw.-hr. of energy during 1936, as against 2,185,825,000 in 1935.

•

Patman Drops Appliance Ban

Representative Patman of Texas has abandoned his proposal to prohibit power companies from retailing electric appliances. He explained that investigation disclosed that powers of the federal government to regulate interstate commerce would reach only a few companies dealing in appliances, since most of this business is of an intrastate nature. He said that if any regulation is imposed it would have to originate in the states.

•

Floodlighting Plan for Coronation Made

The floodlighting program for the British Coronation will be on the largest scale ever attempted in the United Kingdom. The same buildings will be illuminated as at the Silver Jubilee in 1935, including Buckingham Palace, the Victoria Memorial, St. James's Palace, the Horse Guards, National Gallery, Big Ben Clock Tower, Westminster Abbey, St. James's Park and the Admiralty Arch. In addition the House of Commons Terrace, Tower of London, Hampton College and St. George's Chapel (Windsor) will be illuminated.

Every assistance is being given in connection with the floodlighting by the various manufacturers of floodlighting equipment, the Electric Lamp Manufacturers' Association and the electric light authorities. No charge is being made by the London Associated Electricity Undertakings for electricity consumed.

Los Angeles Bureau to Spend $2,600,000

Bureau of Power and Light, Los Angeles, Calif., plans expenditures of about $2,600,000 during 1937 for construction and operations, exclusive of buildings. One of the primary projects will be a new power substation for receiving service in connection with power supply from the Boulder power plant of the government, Boulder Dam.

This plant, to be known as Station E, will be located on Clybourne Avenue, San Fernando Valley, consisting of a reinforced-concrete control house, estimated to cost $60,000, oil house, repair shop, tanks, pumping units, outdoor racks, control tunnels and miscellaneous structures. Current will be received at 110,000 volts and stepped down to 34,500 volts. The station will be used for service at Glendale and Burbank.

Extensions and improvements to existing distribution and industrial substations are estmated to cost about $700,000 of fund noted. In addition to the appropriation noted, other expenditures will be made for line construction to tie in with the system of the Los Angeles Gas & Electric Company; the cost of materials and equipment to be purchased for this part of the program has not been estimated up to the present time.

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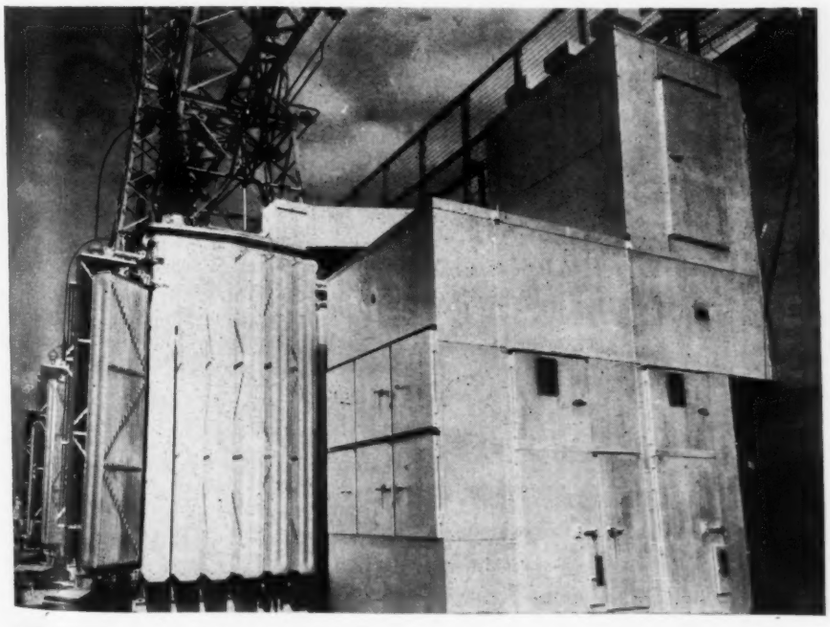

WHEELER DAM SWITCHGEAR—Switching units at the Wheeler power plant of the T.V.A. Designed for outdoor service, they are completely metal-clad, stand 26 ft. high and accommodate breakers of 100,000 kva. at 15 kv. Manufactured by Westinghouse Electric & Manufacturing Company.

Minnesota Installs First Incandescent Highway Units

Minnesota has its first modern incandescent highway lighting system in operation outside Bemidji, where 45 high-visibility units, equipped with 4,000-lumen lamps, light 1.1 miles of a new four-lane highway leading from the city to the junction of U. S. Routes 2 and 71. Installation of the new system, developed by General Electric engineers at Cleveland, Ohio, was authorized by the City Council following a general demand for safety lighting along the new highway.

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Clarks Hill Survey Urged

Senator George of Georgia has recommended to President Roosevelt that the Federal Power Commission make a power consumption survey of the Clarks Hill Dam area, in an effort to find the power demands of the community.

Recent Legislation

Rural electrification measures feature the new legislation introduced in the various state Legislatures:

KENTUCKY—Gov. A. B. Chandler has signed a bill establishing a state rural electrification organization.

MICHIGAN—A bill to provide the machinery for rural electrification by authorizing the formation of non-profit membership corporations of three or more members, to be known as electrical membership corporations, has been introduced in the House. Two other bills, amending present acts, which would permit metropolitan districts and other governmental units to buy, construct, own and operate electric light and power plants have also been introduced. This proposal has been defeated in each of the last three sessions of the Legislature.

WISCONSIN—Four bills have been introduced by Senator Kenneth S. White at the request of the League of Wisconsin Municipalities. The first measure provides that utilities operated by a municipality or a power district would be granted licenses and franchises in the future without first applying to the Public Service Commission. A similar measure has been introduced in the state Assembly. The second bill clarifies the statutes relating to the operation of municipal utilities and provides that the utility may pay into the general fund an amount equal to what its taxes would be if it were a private utility. This payment would be made only after charges for operation, depreciation and interest were met. The third measure provides that a city, town or village has the right to provide facilities for production, transmission or distribution of electricity for the purpose of lighting its streets and buildings or for providing energy for such property. The fourth bill allows municipal utilities to make improvements or additions without applying to the Public Service Commission for permission to do so.

Another measure, known as the Rush bill, would prevent utilities from extending lines in any territory where a co-operative has been incorporated for a period of six months. If during this period, an allotment of money is approved for such a co-operative by the federal government, no public utility would be permitted to begin construction in that territory for a year from the date of incorporation under the proposed bill.

COLORADO—A legislative program, giving the state wide control of public utilities, has been introduced in the Legislature. The bills introduced in the Senate provide for regulation and supervision by the Public Utilities Commission of relations between public utilities and affiliated companies, including holding companies; provide that utilities should pay the expenses of valuation proceedings by the commission, not to exceed 4 per cent of the companies' annual net revenues; confer upon the commission power to regulate and control the issuance of stocks and bonds by public utilities. The bills would also provide that utilities must file complete lists of stockholders of voting stocks, and forbid directors from delegating their management powers to affiliate companies. Another bill would permit cities and towns to establish or acquire public utility plants. Still another measure would formulate non-profit membership corporations to be known as rural electrification corporations.

MARYLAND—A 5 per cent tax on public utilities on the gross sales of electricity, gas, steam and telephone and telegraph service and an additional 2 per cent retail sales tax on the same commodities and services are among a list of "suggested" taxes which Governor Harry W. Nice has sent to the General Assembly now in session. These commodities and services have been exempt from state taxes so far.

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Texans Plan 340-Mile Line

A group of farmers in the vicinity of Bonham, Tex., has made application to R.E.A. for authority and an allotment of $356,000 to construct a rural electric power transmission system, embracing 340 miles to serve 1,200 farmers. It is planned to purchase power wholesale from the Texas Power & Light Company and then distribute it over the co-operative lines to rural subscribers.

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New Units for Indiana

Approximately $36,000 will be spent at Edwardsport by the Public Service Company of Indiana for two new 10,000-kw. generating units and boilers, each with a capacity of 80,000 lb. of steam per hour. The installation will replace obsolete equipment.

Meetings

National Electrical Manufacturers Association—Midwinter meeting, Waldorf-Astoria Hotel, New York, February 14-19. W. J. Donald, managing director, 155 East 44th Street, New York.

American Institute of Mining and Metallurgical Engineers—Annual meeting, New York, N. Y., February 15-18. A. H. Parsons, secretary, 29 West 39th St., New York, N. Y.

Association of Iron and Steel Engineers—National meeting, Ohio Hotel, Youngstown, Ohio, February 25. Brent Wiley, managing director, Empire Building, Pittsburgh, Pa.

American Society for Testing Materials—Committee Week, Palmer House, Chicago, Ill., March 1-5. R. E. Hess, assistant secretary, 260 South Broad St., Philadelphia, Pa.

National Fire Protection Association—Electrical Committee, Atlantic City, N. J., March 9-12. A. R. Small, chairman, 207 East Ohio St., Chicago, Ill.

National Oil Burner and Air Conditioning Exposition — Philadelphia, Pa. March 15-19, C. F. Curtin, exposition manager. Oil Burner Institute, 30 Rockefeller Plaza, New York, N. Y.

Northwest Electric Light & Power Association—Business Development Section, Salt Lake City, Utah, March 25-27. George H. Wisting, section chairman, Northwestern Electric Company, Portland, Ore.

Ease T.V.A. Injunction to Permit Power Sale

The injunction granted nineteen electric companies to halt expansion of the power activities of the Tennessee Valley Authority in competition with the utilities has been modified by Federal Judge John J. Gore to permit the T.V.A. to sell and transmit electric power to the Aluminum Company of America and its subsidiaries over a line from Norris Dam.

Request for modification of the injunction was made by the Aluminum Company, which entered into a contract for an exchange of power before the utilities were granted the injunction by Judge Gore.

The contract provides that T.V.A. use Aluminum Company power in construction of Hiwassee Dam, while Aluminum Company, under the modified order, is permitted to buy "any desired quantity of electric energy" from the T.V.A.

The order was issued without prejudice to the power companies in their claim that the T.V.A. power activities are unconstitutional.

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Northwest Electric Group to Meet in Salt Lake City

The Business Development Section of the Northwest Electric Light and Power Association will hold its annual meeting in Salt Lake City, Utah, March 25-27, according to announcement by George H. Wisting, Northwestern Electric Company, Portland, section chairman.

Davis M. DeBard, Stone & Webster and chairman of the sales committee, Edison Electric Institute, will make the keynote address at the opening session. Others to be heard at this and other general sessions are George M. Gadsby, Utah Power & Light Company, president of the association; W. C. Mainwaring, B. C. Electric Railway Company, vice-president; George C. Tenney, editor *Electrical West*, San Francisco, and Adam S. Bennion, Utah Power & Light Company.

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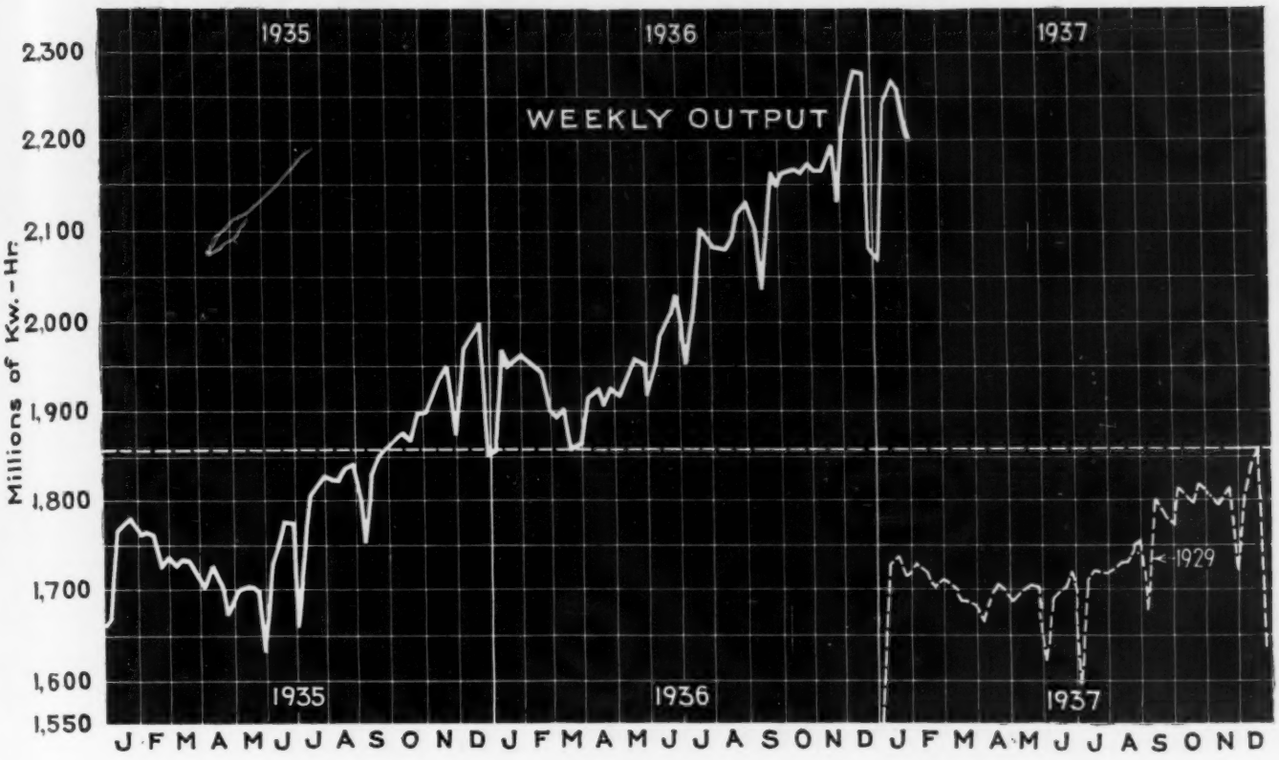
Schenectady Plant Visitors

A total of 131,961 persons visited the Schenectady plant of the General Electric Company during 1936, this figure representing an increase of approximately 8,000 over 1935.

Output 12.1 per Cent Over Last Year



Energy output of the electric light and power industry receded somewhat during the week ended February 6 to 2,201,057,000 kw.-hr., or 0.6 per cent less than in the preceding week, but it was 12.1 per cent greater than in the like period last year. Although the chart shows it to have been appreciably below the recent peak, as was to be expected in view of the usual seasonal movement, it remained larger than in any week in the history of the industry prior to last December.

Compared with a year ago the past two weeks have shown a diminishing rate of gain, suggesting a moderately slower rise in the demand than was manifested last fall.

Regional percentages compared with a year ago show that major gains persist in New England and the Central industrial area, although the figures are 3 to 4 per cent smaller than they were in mid-January.

Weekly Output, Millions of Kw.-Hr.

1937	1936	1935
Feb. 6...2,201	Feb. 1..1,963	Feb. 2..1,783
Jan. 30...2,215	Jan. 25..1,956	Jan. 26..1,782
Jan. 23...2,257	Jan. 18..1,950	Jan. 19..1,778
Jan. 16...2,264	Jan. 11..1,971	Jan. 12..1,773
Jan. 9...2,244	Jan. 4..1,855	Jan. 5..1,669
Jan. 2...2,069	.....	.....

Per Cent Change from Previous Year

Region	Week ended Feb. 6	Jan. 30	Jan. 23
New England.....	+13.9	+14.6	+17.9
Middle Atlantic...	+10.9	+12.7	+14.6
Central Industrial.	+14.0	+15.0	+19.1
West Central.....	+ 7.3	+ 3.1	+ 7.8
Southern States...	+ 9.6	+11.3	+18.3
Rocky Mountain..	+ 5.8	+ 7.4	+ 4.0
Pacific.....	+11.5	+11.3	+12.4
United States.....	+12.1	+14.3	+15.7

Texas Legislature Opposes Brazos River Dam Contract

The Texas House of Representatives has recently adopted a resolution requesting the W.P.A. to reject the contract which has been entered into by the board of directors of the Brazos River Conservation District and the Texas Power & Light Company for the sale of power from hydro-electric plants in connection with a series of flood-control dams to be constructed on the Brazos River. The resolution charged that the contract is not advantageous to the consumers of electricity inasmuch as it does not require the power and light company to reduce rates.

In addition the resolution called on the W.P.A., which is furnishing funds for the $30,000,000 project, not to approve any contract which does not adhere to the policy of the T.V.A. requiring power companies purchasing the power to pass savings on to consumers.

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Plant Acquisition Affirmed

Wisconsin Public Service Commission has affirmed an order authorizing the village of Friendship, Adams County, to take possession of the local electric plant upon payment of $13,000 to the Wisconsin Power & Light Corporation.

To Acquire New Properties

Option has been taken by the Appalachian Electric Power Company on the Floyd Electric Power Company at Floyd, Va. Appalachian is studying the possibilities of buying the property. The company has also started construction of a 32-mile extension from Riner, Va., to the Floyd county line via Willis.

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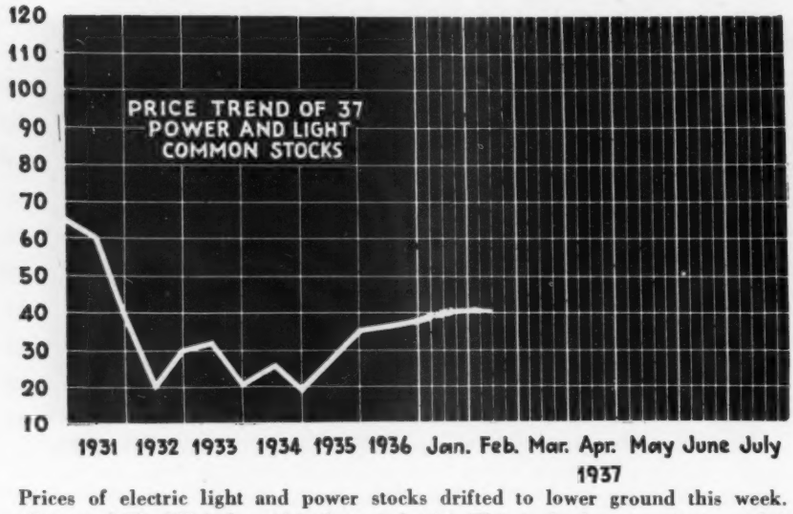
Curb Lists Reliance Stock

The New York Curb Exchange has approved the application of the Reliance Electric & Engineering Company for listing 150,000 outstanding shares of common stock, par value $5.

Light and Power Stocks Lower



Prices of electric light and power stocks drifted to lower ground this week. "Electrical World" index, 40.1; last week 40.4 This is the lowest point recorded since the first week in January, when the index stood at 39.1

Southwestern Light Plans to Refund

Southwestern Light & Power Company, a subsidiary of Public Service Company of Oklahoma, is next on the debt-refunding program for operating utility companies in the Middle West Corporation system.

At a special meeting on March 6 stockholders will be asked to authorize creation of bonded indebtedness, not to exceed $15,000,000, to be issued in one or more series from time to time, and also the issuance and sale presently of $7,250,000 principal amount of series A bonds. With the proceeds the company will retire its existing funded debt of about $7,000,000, consisting of series A and series B first mortgage 5 per cent bonds.

Proposed new bonded debt authorization of $15,000,000 compares with existing authorization of $100,000,000. The $7,250,000 issue was filed this week with the S.E.C.

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Canadian Utility to Refund

Southern Canada Power Company, Ltd., has called for redemption its first mortgage 5 per cent 30-year gold bonds. They will be redeemed April 1 at 102½ per cent and accrued interest. The amount of bonds outstanding is $6,000,000. At a special meeting on December 18 last shareholders approved creation of new bonds and some three weeks ago the company announced that application had been made to the Quebec Electricity Commission to issue $6,000,000 of the new bonds, carrying a 4½ per cent coupon and maturing in 25 years for the purpose of refunding the existing 5 per cent bonds.

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$18,000,000 Issue Offered by Utility

A new issue of $18,000,000 of general mortgage 3¼ per cent bonds was offered last week by the Atlantic City Electric Company at 101 and accrued interest. The net proceeds to be received from the sale of these bonds, due in 1964, will be used as follows:

To purchase from the American Gas & Electric Company for cancellation certain bonds; to deposit with respective trustees of cash equal to the principal and premium required for redemption of bonds of Atlantic City company amounting to $3,887,520, and bonds of the Electric Company of New Jersey amounting to $1,255,112; to deposit with the trustee of the mortgage securing the bonds registered hereunder, in trust, of cash equal to the remaining $1,808,000 principal amount of Atlantic City Electric first and refunding mortgage 5 per cent bonds, due on March 1, 1938, amounting to $1,808,000. The remainder of the proceeds, with other funds, will be used to pay an open account debt due to American Gas & Electric Company amounting to $2,200,000.

Dallas Power & Light Company made an offering this week of first mortgage bonds, 3½ per cent series due 1967, a piece of financing involving $16,000,000. The bonds were priced at 102¾ and accrued interest.

Through retirement of $125,128,600 outstanding funded debt from proceeds of sale of $130,000,000 first and refunding 3¼ per cent bonds, Philadelphia Electric Company will effect a saving of approximately $1,600,000 annual interest requirements, according to application filed with and approved by the Pennsylvania Public Service Commission.

Commonwealth Edison Asks Plan Approval

The Commonwealth Edison Company and Commonwealth Subsidiary Corporation have filed applications with the Securities and Exchange Commission for approval of its plan for the issuance of additional shares of stock and the acquisition, through exchange of stock, of complete stock ownership of Public Service Company of Northern Illinois, Western United Gas & Electric Company and Illinois Northern Utilities Company. This action follows approval of the plan by Edison stockholders at the January 23 meeting.

Gross expenditures of Commonwealth Edison for extensions to plant and the system are estimated at $12,800,000 for this year, as against $9,500,000 last year.

Commonwealth Edison owns directly, and indirectly through Commonwealth Subsidiary Corporation, 32.97 per cent of the voting power of Public Service Company of Northern Illinois, and, also through Commonwealth Subsidiary, 60.16 per cent of the voting power of Western United Gas & Electric and 48.47 per cent of Illinois Northern Utilities Company.

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Johns-Manville Files Issue

Johns-Manville Corporation has filed a registration statement with the S.E.C. covering 100,000 shares of common stock, no par, and subscription warrants evidencing rights to subscribe to the common shares. Holders of common stock as of February 19 will be offered rights pro rata to subscribe on or before March 11 to the additional 100,000 shares of common stock. For each share of outstanding common stock held the company is to grant the right to subscribe to two-fifteenths of a share of additional common stock. Any stock not taken by stockholders will be sold to underwriters at a price to be supplied by amendment.

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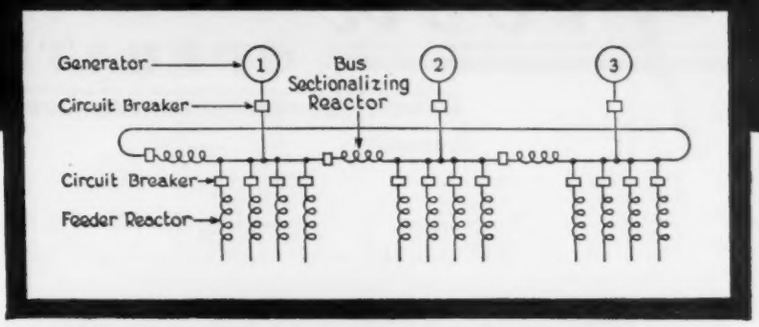
Middle West Fees Allowed

Federal Judge James H. Wilkerson of Chicago has allowed $57,500 in additional and "final" fees and $3,454 expenses in connection with the reorganization of the Middle West Utilities Company.

IMPROVE SERVICE WITH REACTORS?

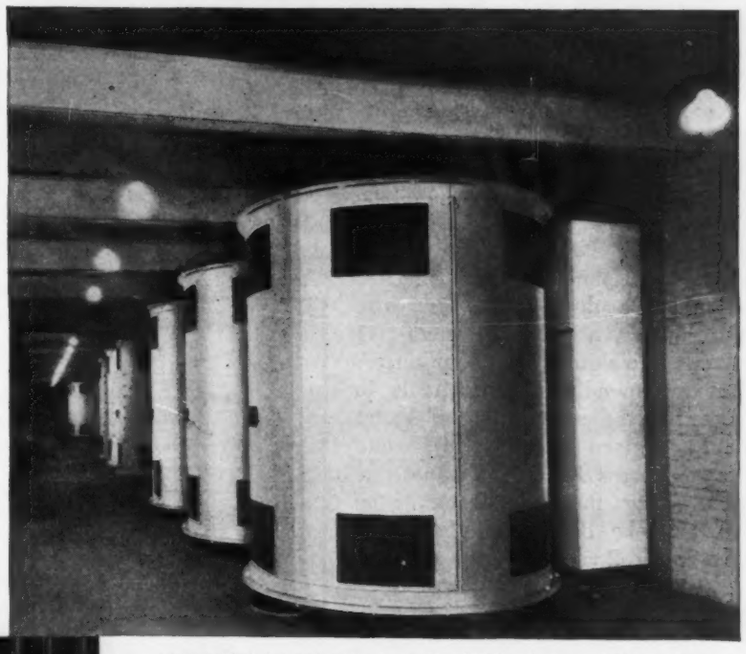
HOW?



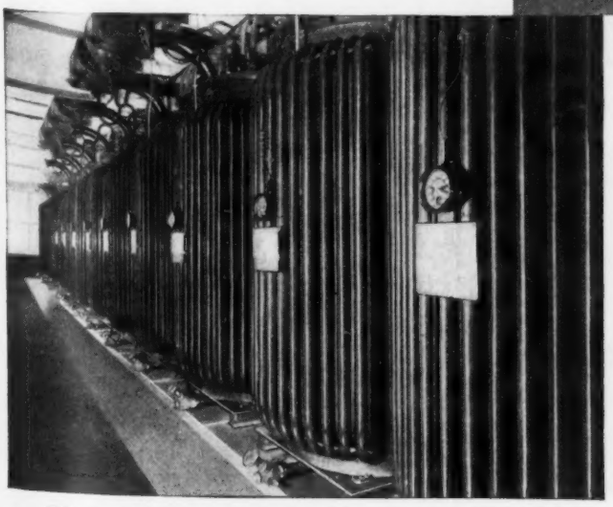
Bus-sectionalizing and feeder reactors used with a ring-bus arrangement

REACTORS protect your service by localizing the effects of short circuits. Installed in feeders or as a bus-sectionalizing device, they limit short-circuit currents to safe values. Should a fault occur in a feeder, the reactors permit the maintenance of bus voltage, and other feeders connected to the same bus continue in service. Maintenance of the bus voltage practically eliminates outages due to loss of synchronism.

Reactors limit the magnitude of fault currents and reduce mechanical and thermal stresses on station lines and apparatus. By limiting the magnitude of short-circuit currents, they reduce the severity of fault damage at the point of fault—a factor which could, in case of a serious short circuit, more than repay the cost of installation.



G-E metal-clad, cast-in-concrete reactors. The housing completely encloses each reactor phase with metal at ground potential. Usually no further enclosure is needed. For bus or feeder applications, 33,000 volts and below



Oil-immersed reactors for circuits of any voltage. These completely sealed units provide maximum reliability

Both Cast-in-concrete and Oil-immersed

General Electric makes both types of reactors, and will be glad to discuss their application with you—to help you select the type best suited to your requirements. For a complete description of G-E reactors, ask for Bulletins GEA-976A and GEA-1090. General Electric, Schenectady, N. Y.

310-18

GENERAL ELECTRIC

Field OPERATING PRACTICES

New ideas and practices in the operation of well-designed, constructed and maintained plants and systems

Dual Metering Finds Circuit Power Factor

A convenient method of determining the power factor and reactive component of a polyphase load was described before a meeting of New England metermen by H. J. Blakeslee, president the States Company, Hartford, Conn. Connections for using the method in a three-phase, three-wire circuit are given in Fig. 1, where (A) and (B) are similar watt-hour meters with corresponding current coils in series. If the registration of meter (A) for a given period equals A and that of meter (B) for the same time equals B, then the power factor of the load may be determined from the curve in Fig. 2 where the power factor is plotted in terms of the ratio A/B. The power factor is the weighted average value for the time interval covered.

The reactive component and the power factor may also be computed from the meter registrations by using the following equations, where R equals the reactive component:

(1) $R = (2B - A)\ \text{Tan}\ 30°$

(2) $\text{Power factor} = \dfrac{A}{\sqrt{A^2 + R^2}}$

In using three-element meters the same arrangement of potential coils connected to voltage sources with 60 deg. lag in phase with respect to the second meter (B) is employed. The determinations of reactive component and power factor are the same as in the two-element meter set-up.

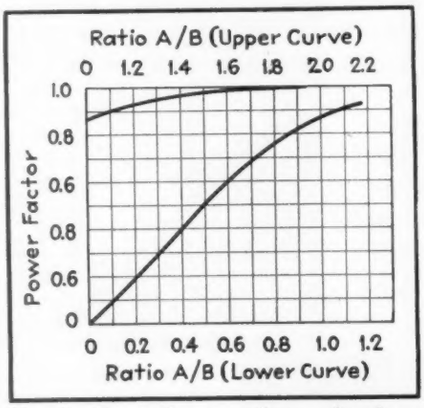


Fig. 2—Power-factor values related to ratio of integrated meter readings

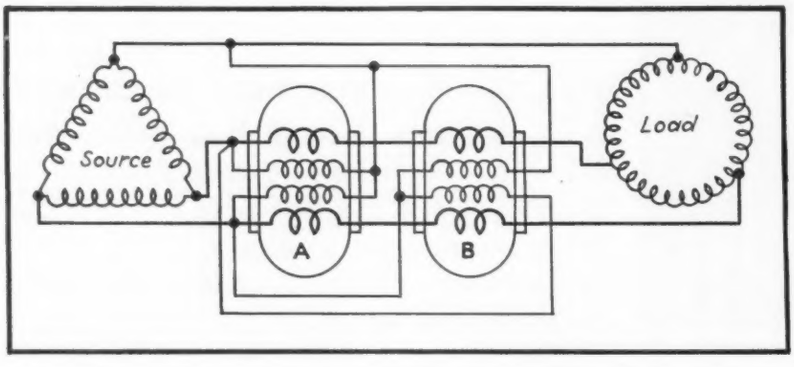


Fig. 1—Two watt-hour meters determine power factor and reactive components

Meter (A) integrates active power over time in the normal manner, having two current and two potential coils as shown. Each potential coil of meter (B) is connected to a voltage source lagging 60 deg. in time phase with respect to the potential applied to the corresponding voltage coil of meter (A).

Momentary values derived from the disk speeds and constants of watt-hour meters or from indicating wattmeters used in their places are components of apparent power. The active component is of course that measured by meter (A) in all cases. The component measured by meter (B) may be considered as the component displaced 60 deg. with respect to the other component.

The watt-hour meter (B) when connected as shown will rotate positively for load conditions in which the current is in phase, or out of phase to the extent of any angle less than 90 deg. lagging or 30 deg. leading. If the current is normally leading it may be preferable to connect the voltage coils of meter (B) to a voltage source leading 60 deg. with respect to the potential applied to the corresponding elements of meter (A). For test purposes a double-pole, double-throw switch can readily be installed to connect the potential coils of meter (B) in the same manner as those of meter (A) or to connect them 60 deg. out of phase with the former at will.

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Oil Protects Finish of Switchgear Panels

By H. L. BYRD
General Electric Company
Philadelphia, Pa.

A little of the lightest grade of lubricating oil will do wonders for the appearance of that new (or old) dull black lacquered switchboard panel in your plant. Applied over the final finishing coat of lacquer it will pro-

AUTOMATIC NEWS SWITCHING

SWITCHGEAR HEADQUARTERS ★★★★★

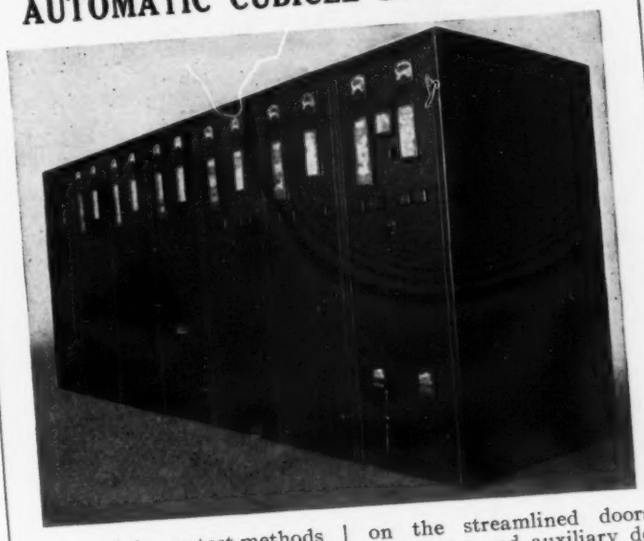
9 QUESTIONS ARE ANSWERED AUTOMATICALLY

In the literal sense, automatic switchgear cannot "think." But many of the operations it performs involve an almost human ability to observe, exercise judgment, and make decisions.

For example in one installation of G-E automatic switchgear for controlling synchronous converters, the switchgear must ask nine questions and determine the answers before it starts the converters. The nine precautionary checks include the following:

1. Is the voltage up to normal?
2. Are all phases closed and properly connected?
3. Are the brushes of the converter raised?
4. Was previous shutdown caused by a-c overcurrent?
5. Was previous start normal and did not take an undue amount of time?
6. Was converter overspeeded prior to last shutdown?
7. Is temperature of machine normal?
8. Is converter field intact?
9. Are converter windings free from grounds?

AUTOMATIC CUBICLE SWITCHGEAR



One of the neatest methods of mounting automatic switchgear is in cubicles similar to those shown here. Semiflush meters, relays, and instruments are mounted on the streamlined doors, contactors and auxiliary devices are mounted inside, out of the way of dust, but immediately accessible for inspection and testing.

G-E Engineers Will Help You Plan Your Automatic Equipment

When you are planning automatic-switching installations, you may find it profitable to take advantage of our experience in designing and building all types of automatic-switching apparatus. Just call the nearest G-E office. General Electric Company, Schenectady, N.Y.

SIMPLIFIED TWO-WIRE SUPERVISORY

By means of a compact two-wire equipment, a maximum of five different operations in a remote substation may be supervised from a distant dispatcher's office.

Dispatcher's desk cabinet (Approx. 18 in. square)

The equipment in the dispatcher's office is mounted in a desk-type cabinet. The equipment at the substation is assembled in a case for panel mounting. The apparatus gives the dispatcher control and indication of units supervised. Selective meter readings may also be obtained over the same line wires by the addition of telemetering equipment.

CONTROL FOR HYDRO-PLANT GENERATORS

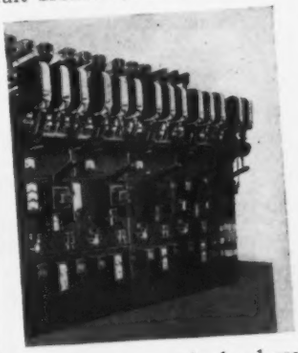
The efficiency of modern automatic switchgear, and its adaptability to the requirements of specific jobs, are illustrated by a recent G-E installation for the control of two 17,000-kva generators.

This completely automatic switching equipment includes automatic speed-matching and synchronizing apparatus. Each station is provided with supervisory control and telemetering equipment which place it under the supervision of a central load dispatcher's office, 10 miles from the substation.

Generator-field regulating equipment is provided to hold constant power-factor within given voltage limits during normal operation. During the starting and synchronizing periods, it holds the generator voltage at normal.

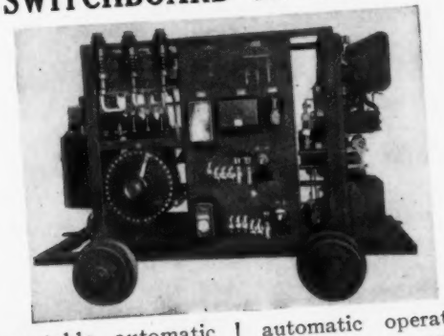
Automatic Reclosing Feeders Keep The Wheels Turning

This switchboard mounts the necessary automatic equipment, including air circuit breakers, for four three-



phase and one single-phase, 440-volt a-c reclosing feeders. The relays open the breakers on overloads or short circuits, but immediately reclose again, keeping the supply of power uninterrupted unless the overload still burdens the feeder.

SWITCHBOARD ON WHEELS



G-E portable automatic switching units for mining service add the advantage of mobility to the other benefits obtained from standard automatic operation. This unit controls a 150-kw, 275-volt, full-voltage-started synchronous motor-generator.

GENERAL ELECTRIC

880-11

tect the finish almost indefinitely. When all surplus oil is carefully removed surfaces protected in this way show dust even less conspicuously than untreated panels.

Apply the oil to existing panels in a thin, even coating. After several hours remove all surplus oil with a clean, slightly oiled cloth. If it is necessary to repair a damaged spot remove the oil with carbon tetrachloride or similar solvent and proceed with repair as usual. Before oiling the finished spot let the finishing coat of lacquer stand at least 24 hours. This gives the thinner time to evaporate completely.

This procedure in a plant will give a uniform appearance to both old panels and extensions of new equipment. Panels which have been in service for a long time may be "brushed up" by wiping them with a soft cloth containing a small amount of light machine oil.

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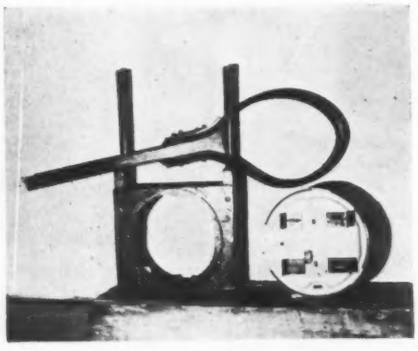
Special Wrench Eases Meter Cover Removal

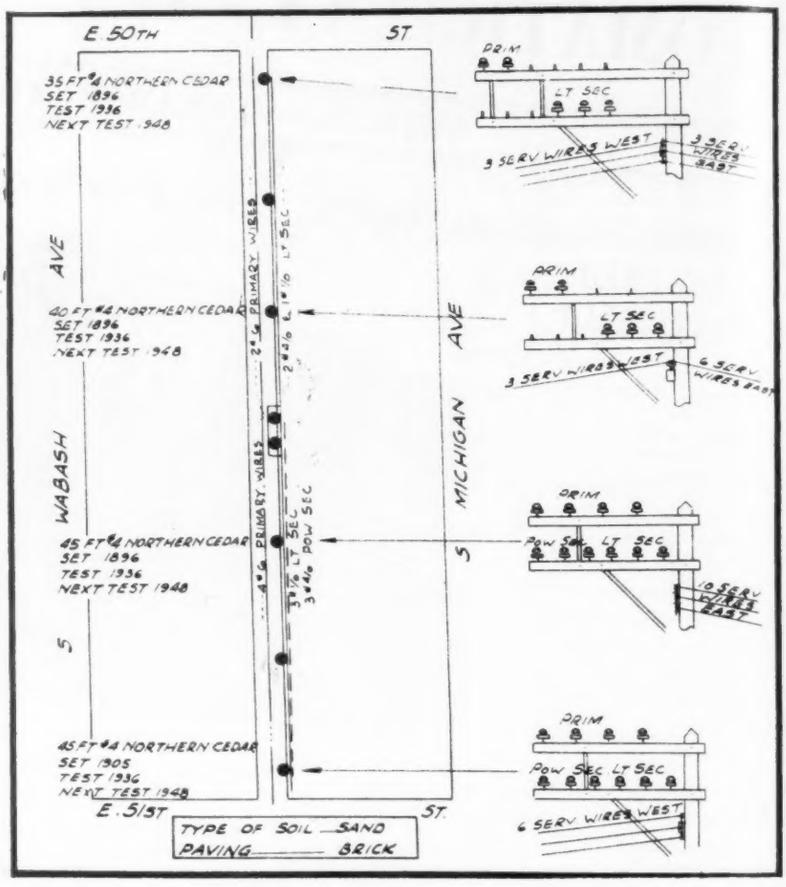
By E. J. SINGREY
Meter Department
Northwestern Electric Company, Portland, Ore.

For removing the glass covers from socket type meters the meter department of the Northwestern Electric Company has developed a type of wrench similar to those used to remove the covers from mason jars. A special arbor for holding the base was built and mounted on the work bench. A leather strap was bolted in a loop to the end of a long wooden handle. The leather strap encircles the metal ring on the glass cover of the meter, the long handle providing plenty of leverage to remove stuck glass covers.



Removes glass covers from socket type meters

Life of White Cedar Poles



Note the first, third and sixth poles from the top of this map. These three poles, untreated Northern white cedar, were set in 1896, 40 years ago. They were inspected this year and were found in such good condition that the next test was set for twelve years hence, in 1948. By that time their life will be 52 years. This information is from pole records of Commonwealth Edison Company, Chicago.

Interconnection Cuts Transformer Outages

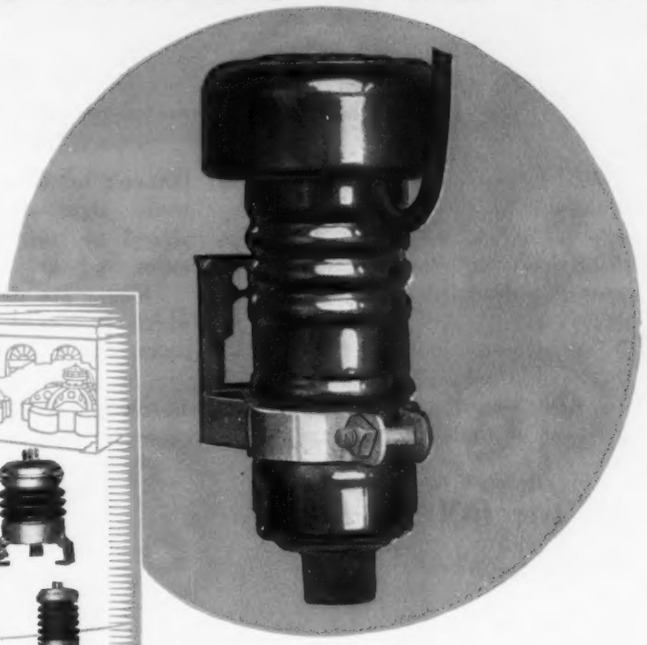
"Lightning arresters properly interconnected are of sufficient value to warrant installation on all transformers regardless of size." So concludes the report of the Indiana & Michigan Electric Company covering transformer protective practices on rural lines, presented before the Michigan Electric Light Association recently by George F. Dequine.

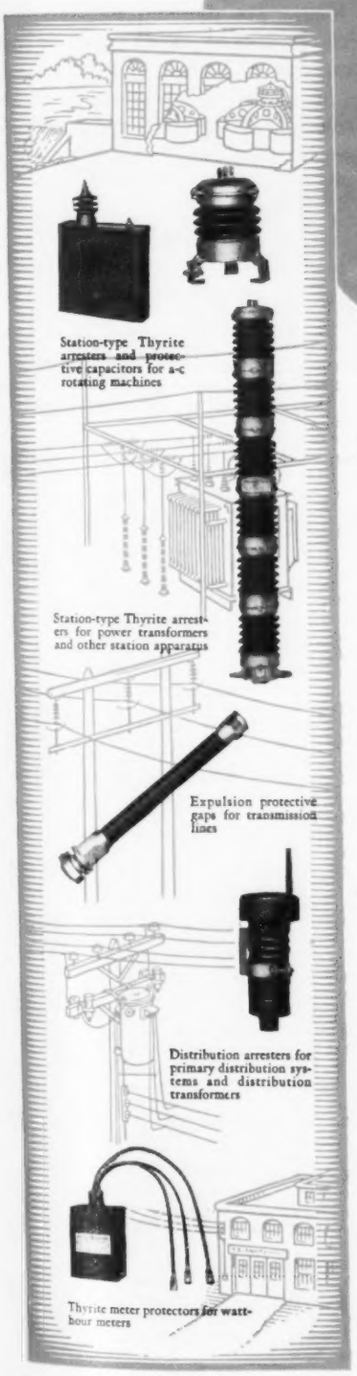
Interconnection of lightning arrester ground to the secondary neutral for transformer protection was begun by this company in 1934. As a check on performance accurate records were kept of transformer fuse outage during 1934 and 1935. Examination of these records at the end of the year showed fuse outages of 40 per cent for unprotected transformers. In the same period transformers protected by lightning arresters connected to driven grounds and not interconnected yielded outages of 14 per cent. In several towns where secondary neutrals were connected solidly to continuous water supply systems lightning arrester grounds were solidly connected to the secondary neutral. Lightning outages in these cases were only 2 per cent during 1934.

Three-point protection (a gap between lightning arrester ground and transformer tank and also a gap between tank and secondary neutral) was installed in a few instances, as were a few Westinghouse "surge-proof" transformers. No outages were experienced on transformers protected by the "three-point" method and only 2 per cent on the "surge-proof" transformer installations. These were partly due to small fuses in some instances. Outages of all transformers protected during 1934 both interconnected and not interconnected amounted to approximately 12 per cent.

From experience obtained with in-

A 95 PER CENT REDUCTION IN OUTAGES DUE TO LIGHTNING




Station-type Thyrite arresters and protective capacitors for a-c rotating machines
Station-type Thyrite arresters for power transformers and other station apparatus
Expulsion protective gaps for transmission lines
Distribution arresters for primary distribution systems and distribution transformers
Thyrite meter protectors for watt-hour meters

That's why valve-type arresters applied with interconnection are economically justified with every distribution transformer

★ ★ ★

No other single item in the total investment in your distribution circuits is so insignificant in first cost, yet so vital to the desired return on the total investment, as pellet arresters.

Install G-E pellet arresters with interconnection at *every* distribution transformer — outages will be reduced, and the service life of equipment extended. General Electric, Schenectady, N. Y.

★"DURING the year 1934 on transformers not equipped with lightning arresters, fuse outages amounted to 40 per cent . . . on transformers protected by arresters . . . we connected the lightning arrester to secondary neutral in several towns . . . and on these installations the outages due to lightning fell to only 2 per cent.

"The excellent results obtained from interconnection, and the large percentage of outages on transformers not protected by lightning arresters, have convinced us that lightning arresters properly interconnected are of sufficient value to warrant installation on all transformers regardless of size."

The Insignificant Additional Cost for Arresters Assures:

Lightning stresses on transformers limited to the minimum.

Primary-fuse blowing practically eliminated.

Development of power arcs, short circuits, and feeder outages prevented.

Possibility of primary power reaching secondary circuits definitely reduced.

And this Means for You:

Greatly decreased maintenance.

Largest return on over-all investment in rural extension.

A reliability of service conducive to load growth.

★ Statement published by a Midwestern operator in an industry journal.

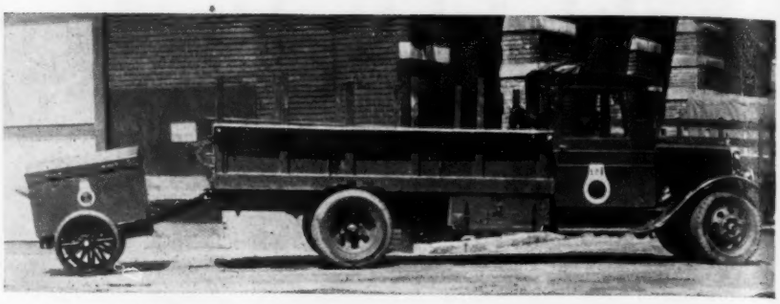
COMPLETE LIGHTNING PROTECTION FROM THE GENERATOR TO THE METER

330-254

GENERAL ELECTRIC

terconnection of lightning arrester and secondary neutral during 1934 it was decided that all transformers equipped with lightning arresters should be interconnected. As a consequence of this move outages of transformers protected by arresters and interconnection were reduced from 12 to 6 per cent in 1935. Practically all types of protection were used, including several "self-protected" transformers. The type of protection which was only about 90 per cent effective was that in which a gap was installed between the lightning arrester ground and secondary neutral without the transformer case being grounded to the lightning arrester ground. Bushing flashovers encountered with this type of protection were found to be preventable by solidly grounding the transformer case or installing a gap between case and ground.

Metal Tool Carts Stop Petty Thievery

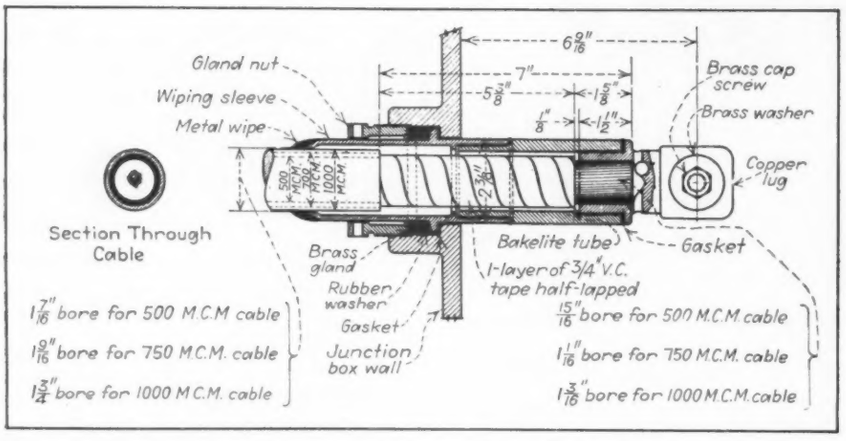


To accommodate more splicer's tools and to thwart the petty thieves who preyed on the wooden tool rigs the Kansas City Power & Light Company has designed a new metal tool cart.

The all-metal tool carts weigh 725 lb. empty and approximately 1,350 lb. when loaded with a complete assortment of tools for splicing a 33,000-volt oil-filled cable or installing traffic signals, etc. They are designed to trail when loaded at 30 miles an hour.

Thieves are daunted by the cover, which is locked down by two bolt locks, one at either end. This cannot be pried off without complete destruction of the cart. A piano-type hinge is used.

Oil-Tight Terminals for 600-Volt Paper and Lead Cable



600-volt G.E. Type No. 93 junction box with 600-volt, 1,000, 750 or 500,000-circ. mil, single-conductor, paper and lead cables

The termination of a cable, especially a paper cable, is still one of the most difficult problems for the electrical engineer. Unless every detail is carefully planned in advance failures will occur. The Detroit Edison Company has worked out standard instructions for every type of terminal that is used on its system. The following is an example of the great care that is required in each case.

Bill of Material

1 G. E. type No. 93 junction box—4, 6, 8 or 10 way as specified for the job.

The following material is required for each cable entering the box:

1 Oil-tight cable entrance for G. E. type No. 93 junction box to fit cable used
½ roll ¾-in. varnished cambric tape
¼ lb. Wiping metal
1 oz. Stearine
1 oz. Soldering paste
2 ft. Flint cloth
¼ lb. Bags
10 yd. Binding twine
3 ft. Pasters
3 in. Asbestos tape
Silicate of soda (glue)
1 oz. Shellac

Operations in Making Up

(a) Mount junction box on wall per instructions for particular job.

(b) Train cable in front of box. Adjust tag.

(c) Mark cable sheath at center line of bolt hole at which entrance lug is to be fastened.

(d) Measure 1½ in. away from mark on side away from end of cable. Cut cable at this point.

(e) Saw off end of wiping sleeve to fit cable, file inside edge, and tin.

(f) Slip gland nut, brass gland (with sloping side toward end of cable) rubber washer, wiping sleeve with gasket, and bakelite collar over end of cable in the order named. Push back out of way.

(g) Measure 7 in. from end of cable. Crease sheath.

(h) Shave cable sheath near crease. Smear shaved surface with Stearine.

(i) Remove sheath back to crease. Do not bell end of sheath.

(j) Tie insulation 2 in. from end of cable. Remove insulation from conductor for 1⅝ in. from end. Cut end of insulation square.

(k) Slip gasket for use between bakelite collar and shoulder of lug, over insulation and back to end of sheath.

(l) Apply two layers of half-lapped ¾-in. friction tape over threads of lug, carrying second layer over shoulder of lug. Stuff jumper hole of lug with asbestos tape.

(m) Tin end of conductor. Heat lug by holding threaded end in hot metal. Sweat lug on conductor, taking care that lug is straight and has flat side parallel to wall.

(n) Remove friction tape as quickly as possible and brush threads with file brush to remove any solder that is lodged on them. Remove asbestos from jumper hole.

(o) Apply ¾-in. varnished cambric tape in the slot between lug and factory insulation. Build up flush with factory insulation.

(p) Remove binding cord from factory insulation. Apply two layers of half-lapped varnished cambric tape over entire length of exposed insulation.

(q) Paint both sides of gasket with shellac and put in position against shoulder of lug.

(r) Screw bakelite collar onto lug and tighten snug against gasket with strap wrench.

(s) Paint both sides of gasket with shellac and put in position against shoulder of bakelite collar.

(t) Paint threads on outside of bakelite collar with shellac and screw wiping sleeve tightly in place.

(u) Wipe wiping sleeve to cable sheath.

(v) After wipe cools slip rubber washer, brass gland and gland nut over wiping sleeve, snug against the shoulder.

(w) Paint both sides of the gasket between shoulder of wiping sleeve and side of box with sealing varnish and put in place on wiping sleeve.

(x) Train cable carefully into junction box and screw gland into side of box. Tighten with special wrench.

(y) Repeat operations b to w, inclusive, for each cable entering junction box.

(z) Attach bonding connection to all cables.

(aa) Apply fireproofing from duct face to gland.

(bb) Fasten tags in proper locations.

(cc) Install fuses as specified on mains.

(dd) Install fuses on feeders and services on order from system operator or foreman.

(ee) Place cover gasket in place and bolt cover on box.

WAGNER Rural-Line Distribution Transformers

TYPE HEB-F

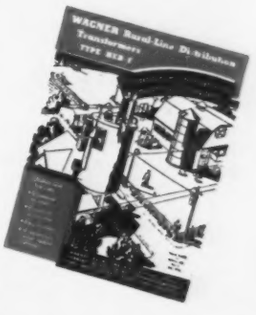
For operation on solidly-grounded common neutral systems

- Reduce rural-line costs
- Economical to install
- Economical in operation
- Easy to mount
- Adequate protection against lightning

Wagner type HEB-F rural-line distribution transformers meet the need for a small inexpensive unit designed for application to lines of 13,200 Y volts and below. Some of the advantages of Wagner rural-line transformers are:

1. Cost is reasonable, yet consistent with good operating economy.
2. Design is adaptable to any kind of system or type of line service.
3. They are self-protecting against lightning.
4. Bushings, mounting brackets, gaps, connectors, etc., are so arranged as to facilitate installation and maintenance.
5. Their operating efficiencies are within prescribed limits for economical performance.
6. Construction is representative of the latest development in design and manufacture.

If you want more details about Wagner transformers that are especially designed for rural electrification service, write for the Wagner Bulletin Form S488. TD237-1B



Wagner Electric Corporation

6400 Plymouth Avenue, Saint Louis, U.S.A.

MOTORS · TRANSFORMERS · FANS · BRAKES

Industrial ELECTRIFICATION

New ideas and practices in industrial electrification as presented by industrial, consulting and power sales engineers

Photo-Cell Gages Coal Car Sprinkler

Installation of a photo-tube sprinkler control at the Presque Isle, Mich., docks of the Chesapeake & Ohio Railroad has removed the personal element previously employed in wetting down coal cars before dumping. Formerly it was left to the operator to start and stop the car sprinkler. Now as the front of the car passes through a light beam a photo-tube control energizes a solenoid valve and the sprinkler operates with unerring precision. When the rear end of the car passes beyond the light source, light again falling on the receiver causes the solenoid valve to close. Should the light source fail, which it seldom does, the flow of water will automatically be stopped after a predetermined interval, corresponding to the time required to sprinkle an average car.

Westinghouse photo

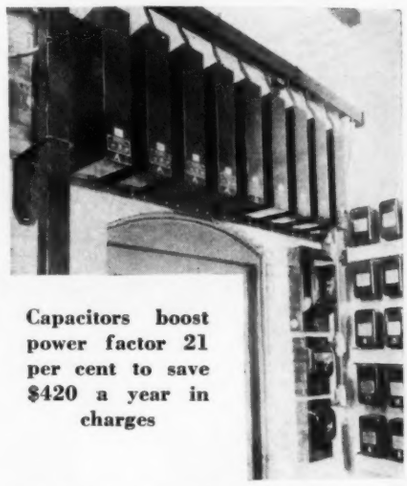
Photo-tube control sprinkles coal cars automatically. Arrow indicates control

Limit switches have been applied to this job with dubious success. Such an arrangement does not provide for variations in the length of different cars. This leads either to neglecting a long car or wasting water on a short car.

•

"Statics" Paid Their Way Here

With a 68 per cent power factor, the Florence Dye Works, Woonsocket, R. I., purchased energy on a rate providing for a penalty in this range amounting to $22.35 per month. The demand was 80 kw., and without correction the demand charge would have totaled $149 per month, against a former figure of $127. A study was made of the effect of six Dubilier static condenser combinations, and as a result, nine 5-kva. units were installed as illustrated, over the door of the switchboard room. Four were located on the main bus, three on a dye kettle feeder and two on the gill room feeder. These brought the new power factor to 89 per cent, cutting the demand charge to $114 per month and saving $420 per year over the $149 per month uncorrected power-factor demand charge. The cost of the capacitor outfit was $1,142, giving a ratio of saving to cost of 36.8 per cent. That is, the investment was liquidated in a little less than three years.



Capacitors boost power factor 21 per cent to save $420 a year in charges

To facilitate cost analyses for various corrective capacities the accompanying self-explanatory tabulation was prepared by Albert Dauray of

Present Load 80 Kw. at 68 per Cent Power Factor

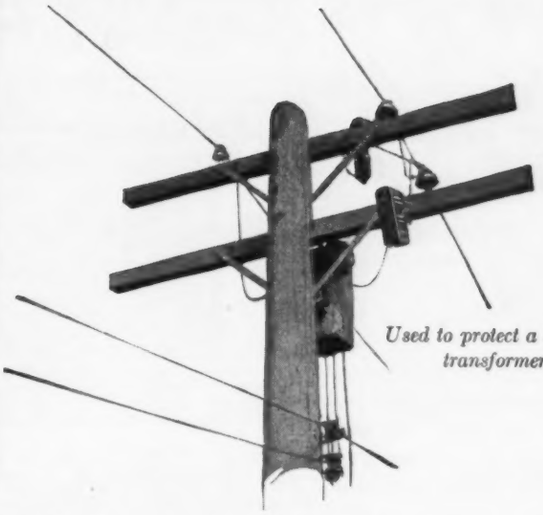
220 Volts

Present Kw. Demand	Present Demand Charge	Penalty per Month	New Demand Charge Less Capacitor	Size Capacitor Unit Kva.	New Power Factor	New Demand With Capacitor	Savings per Year	Cost of Capacitor F.O.B. Factory	Ratio of Saving to Cost, per Cent
80.....	$127.00	$22.35	$149.00	30	82	$124.00	$300.00	$759.00	39.5
80.....	127.00	22.35	149.00	25	79	129.00	240.00	640.00	37.5
80.....	127.00	22.35	149.00	35	84	121.00	336.00	904.00	37.2
80.....	127.00	22.35	149.00	45	89	114.00	420.00	1142.00	36.8
80.....	127.00	22.35	149.00	50	91	112.00	444.00	1261.00	35.2
80.....	127.00	22.35	149.00	60	95	108.00	492.00	1518.00	32.4

THERE ARE

Definite Reasons

WHY THERE'S AN INCREASING DEMAND FOR



Used to protect a 6.6 Kv. transformer.

SOLDERLESS CON-NEC-TITES;
T CON-NEC-TITES;
LAP-TITE CONNECTORS;
TRIP OUT FUSE SWITCHES;
TRIP-O-LINK FUSE SWITCHES;
TRIP-SAVER FUSE SWITCHES;
ONE AND TWO INSULATOR FUSE AND DISCONNECT SWITCHES;
PORCELAIN HOUSED TRIPOMATIC FUSE CUTOUTS;
DOUBLE DUTY FUSE CUTOUTS;
POLE TOP GANG OPERATED SWITCHES;
PORCELAIN HOUSED DISCONNECT SWITCHES;
N. E. M. A. HOOK OPERATED DISCONNECT SWITCHES;
FUSE LINKS;
FUSE LINK BOXES;
FUSE PULLERS;
SECONDARY FUSES;
SCREW ANCHORS;
EXPANSION ANCHORS;
FULL-VU GUY GUARDS;
GUY WIRE CLIPS AND STRAND BANDS;
ECONOMY CABLE CLAMPS;
DEAD-END SERVICE CLAMPS;
V-GROOVE SERVICE CLAMPS;
HITEMETERS;
"J" HOOKS;
CONDUIT STRAPS;
ABC SLEEVES AND MACHINES;
CABLE RING SADDLES;
FIT-RITE WIRE HOLDERS;
SLEEVE TWISTERS;
GROUND WIRE CLIPS;
GROUND CLAMP-TITES;
GROUNDING CABLE;
HI-LINE TOOLS AND ACCESSORIES;
CON-NEC-TAP CLAMPS;
GROUNDING SETS;
MASTERENCHES

TRIPOMATIC *FUSE* CUTOUTS

Consider these

FEATURES OF THE TRIPOMATIC

SWIVEL HANGER—all round, clamp-type—strengthens the crossarm. Swivel joint permits facing box toward lineman. Hanger bolted to porcelain.

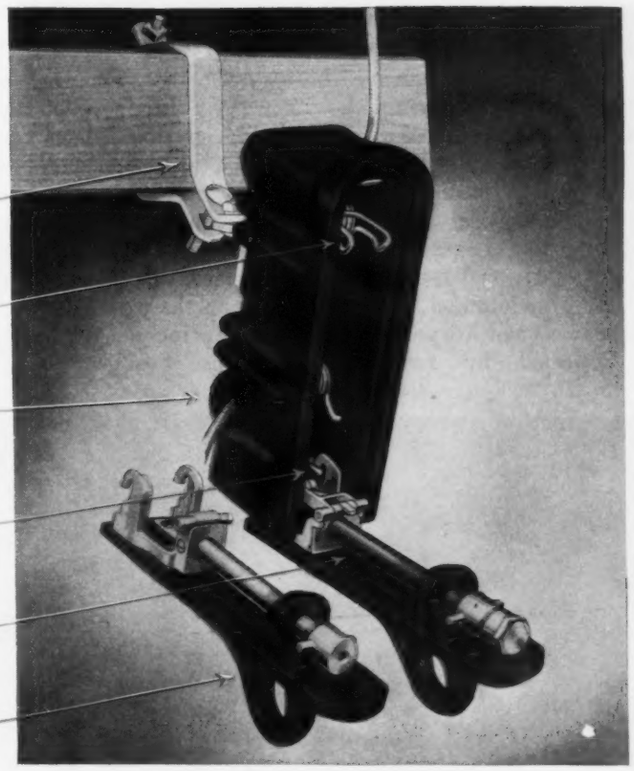
UPPER CONTACT — Kearney Point Pressure Type, is combined with latch.

LEAD CONNECTIONS — made by clamp-type terminals set in apertures at the back of the box and separated from the cartridge chamber proper.

DEAD HINGE — Illustration shows clearance from lower contact. Door is provided with large pull ring.

LOWER FUSE TERMINAL — pressure type contact which eliminates use of wing screws.

DISCONNECT DOOR — Provided with copper blade — Interchangeable with fuse cartridge door assembly.



SWITCH RATINGS

Tripomatics are available in voltages of 5000 V. and 7500/12500 Y Grd.: Amperages 50 and 100. Disconnect blades—75 and 200 Amp.

KEARNEY PRODUCTS

Designed and Manufactured by

JAMES R. KEARNEY CORPORATION
4236 CLAYTON AVE., ST. LOUIS, MO.
FACTORIES AT ST. LOUIS, MO., TORONTO, CANADA

the Electric Maintenance & Engineering Works, Woonsocket, who installed the capacitors.

•

Precipitator Traps China Dust, Glaze

Ten electrostatic dust precipitators are now recapturing four tons of china glaze each week for the Homer Laughlin China Company, Newell, West Va. Since each pound may be worth as high as $200, the equipments will soon pay for themselves out of savings. Installation of these ten units on five glazing machines was by Pangborn.

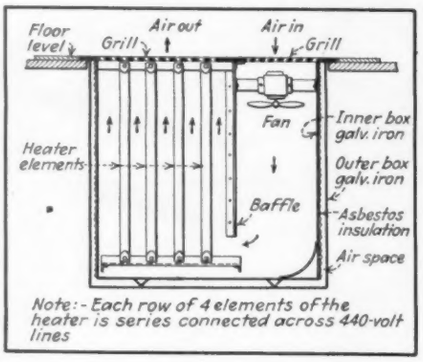
Floor space and cleaning time are but one-tenth formerly required by the settling chambers, which the 98 per cent efficient electrostatic units replaced.

With each automatic machine spouting five dishes a second (300 per minute, 8,000 dozen daily) and spraying 8 gal. (116 lb.) of liquid glaze mixture a minute, the huge settling chambers previously salvaged 1,200 lb. per week of expensive ingredients from the excess spray, but cleaning was a difficult, time-consuming and unhealthful task. The present electrostatic glazesaver snares particles as small as one micron in size, collects an additional 400 lb. of glaze per week (1,600 lb. total), makes available 300 sq. ft. of additional floor space per machine and deposited material is collected by merely hosing-out the ionizing chamber with water. In operation the glaze collected on the plates automatically falls back into the booth and is immediately fed into the recirculating glaze; the only cleaning necessary is to remove the small quantity of glaze at the end of a day which has collected on the plates.

New in principle and invented by Westinghouse researcher Gaylord Penney, each of these 2,400-cu.ft. self-contained electronic precipitators first ionizes incoming particles with 15,000 volts d. c. and subsequently attracts the charged particles to deposit plates by a 7,500-volt d. c. electrostatic field in the collector assembly. Operation cost is negligible, each unit when operating at full capacity consuming but 75 watts.

Each dust precipitator in this china plant has self-contained power pack

Heaters Keep Air Circulation at Floor



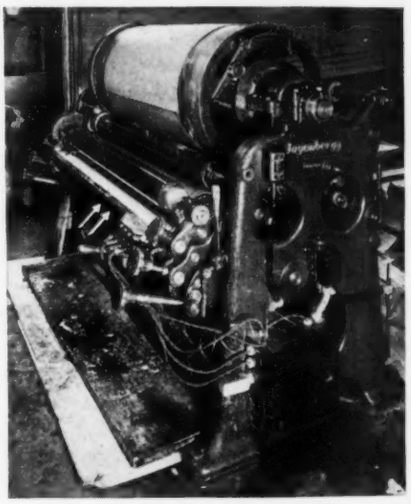
A 6-kw. electric floor heater designed to induce air currents parallel to the floor, preventing heat loss through accumulation of warm air at the ceiling. The fan, operating on 115 volts, forces circulation under the baffle, around the standard strip heaters and through the angular grills. Service to the elements is at 440 volts, control is thermostatic. Fans can be operated separately for cool air circulation in summer. Forty of these units were installed in the 125x300-ft. drafting room loft of the Douglas Aircraft Company in Santa Monica, California.

•

Electric Heat Keeps the Varnish Thin

By H. R. STEVENSON
Detroit Edison Company, Detroit, Mich.

Cold weather thickened up the varnish which a coating machine in a Detroit shop applies to lithographed sheets and allowed much more than enough to adhere to the paper. This considerably slowed down the operation of the machine, since a correspondingly longer time was required for the drying operation.



Heat without fire for varnish coating machine
The arrows indicate locations of four strip heaters applied to underside of varnish pan.

An endeavor was made to correct the trouble at first with flame type heat. The results were most explosive! Shortly afterward four 500-watt strip heaters were applied against the bottom of the shallow open pan containing the varnish and, in connection with a thermostat, they now maintain the varnish at an even temperature that assures a uniform coating for the paper and consistent operation of the machine. It has been found that, due to the location of this machine in a basement space, operation of the heaters in the summer time is advantageous.

By telephone, by telegraph, by air mail and by messenger we have received and immediately executed many recent flood emergency orders for "Meg" and "Megger" instruments to test insulation resistance of electrical equipment during the necessary drying out process.

With sincere regret for the cause of this unusual demand, we derive satisfaction from having been able to render such up-to-the-minute service; and to the extent that additional instruments may be required, we continue ready to make prompt shipments, to quote prices, to offer suggestions and to provide helpful literature. Write for Catalog 1400-BW.

AS TRUE TODAY AS A YEAR AGO!

As always, we are "yours to command"

JAMES G. BIDDLE CO.

ELECTRICAL INSTRUMENTS

1211-13 ARCH STREET PHILADELPHIA, PA.

Incidentally — and this is of added importance — any "Meg" or "Megger" ordered now for flood emergency service, will be permanently available for definitely worth while routine insulation resistance tests after the return of normal conditions.

We illustrate "Meg" Insulation Tester Cat. No. 675; range 0-100 megohms, with 500-volt d-c generator; price $142.50 net f.o.b. Philadelphia. Other types and ratings are also available for immediate delivery.

"MEGGER"

TRADE MARK REGISTERED U.S. PAT. OFF.

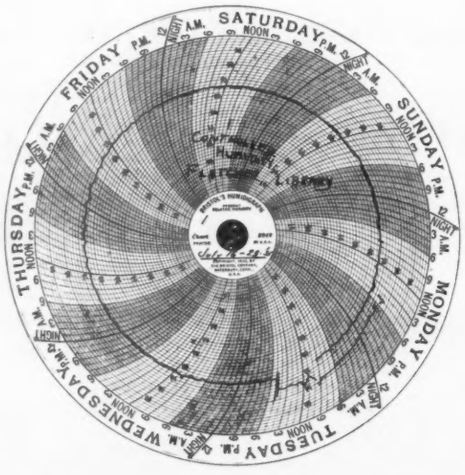
REPRINTED FROM ELECTRICAL WORLD APRIL 11, 1936

Building Up THE LOAD

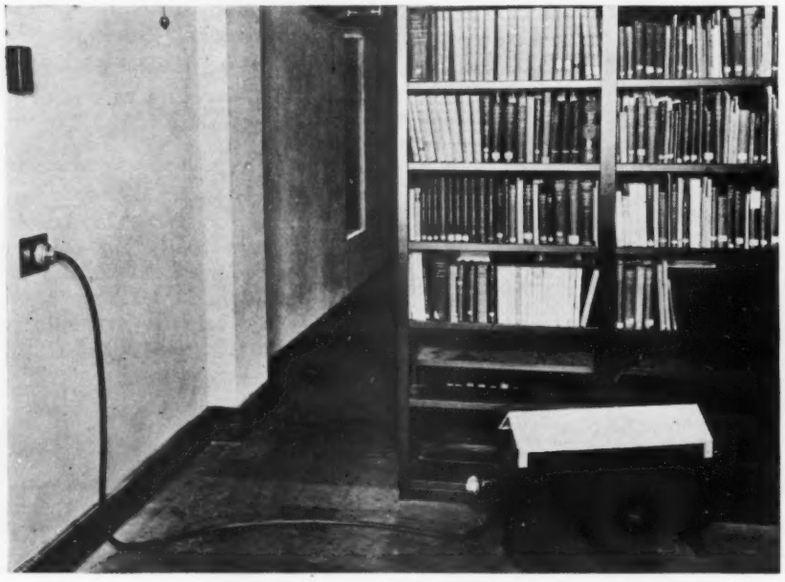
New ideas and practices in selling electrical equipment and service to commercial and domestic customers

Heater Units Prevent Mildew in Book Stack

During the summer the law library at Tufts College, containing about 50,000 volumes, is stored in a basement stack room 8 ft. high with an area of 2,800 sq.ft., and to prevent damage from moisture an installation of four 6-kw. Wiegand electric air heaters was set up two years ago by Prof. J. R. Harrison of the department of physics, at a total cost, including wiring and automatic controls, of about $300. Two of the heaters are held in reserve. The humidity is automatically kept under 67 per cent by Standard humidistats wired to Ward Leonard contactor switches which energize two heaters at 66 per cent humidity on one side of the room and at 68 per cent on the other, and hold it within about 1 point, as shown by the accompanying weekly chart.



Humidity held below danger point day and night in library stack



Valuable books are preserved against mildew in summer by automatically controlled heater units

The humidistats controlling the heaters are located at diagonally opposite points on the stack walls, two being provided. One of these controls the heater pair on the east wall and one the pair available on the west side of the room. The heaters are designed for 220-volt operation and were locally fitted with inclined sheet metal tops to prevent any one using them to support books or papers. Two heaters are held in reserve, inasmuch as experience has shown that the humidity can be held within desired limits by using only two of the units at a time.

The cost of operation in the summer of 1935 was about $90, or 1.8 mills per volume safeguarded, service being supplied by the Boston Edison Company on a separate meter and heating rate. Of interest from a utility's viewpoint is the fact that the installation is used only during the months when steam is off the building and so represents an attractive seasonal load.

•

Salesmen Build Load from Building Plan

Salesmen of the Pacific Gas & Electric Company in the Sacramento Valley have developed a new way of obtaining "tips" for load building. When building permits are issued for a new home the salesmen are given copies of the plan, from which they make recommendations for an all-electric home. However, with these specific suggestions, they approach the builder or owner and explain the

"Kitchen-proved" performance field-tested selling

1937 Westinghouse Ranges . . . Practical Selling Material . . . Created after Nation-wide Investigation . . .

Westinghouse Range owners everywhere talked to investigators in 1936 about their electric ranges. As a result, the 10-model line of 1937 Westinghouse Ranges is improved, simplified, more beautiful than ever — to make volume selling a sure thing.

Top notch Westinghouse Range retailers and retail salesmen the country over had their say. Now every man in your range selling organization can benefit from the experiences of these hard-hitting quota busters.

THE RESULTS ARE YOURS!

Everything in the big 1937 Westinghouse array — sales-training material, selling plans, literature, advertising, displays — is based on "Kitchen-proved" performance and field-tested selling. Seeing is believing. Ask your distributor to show you — or mail the coupon for complete details.

1937 Westinghouse Range Design Emphasizes

"THE BIG FOUR" WOMEN WANT MOST

CLEANLINESS!

1937 Westinghouse Ranges, with their one-piece, and resisting porcelain enamel cooking tops, are easier to clean, better looking. No dirt-catching crevices!

ECONOMY!

Now the improved Economizer Speed Unit with 4 heats, a wider heat-range than on any other surface unit, assures even greater economy.

EASY TO USE!

The 1937 *single-dial* heat control and oven switch simplifies oven cooking — controls preheat, baking, broiling, temperature setting.

BETTER RESULTS!

Now the new, scientific Heat-Evener and new, high-wattage oven units create *balanced heat flow* — give vastly superior cooking perfection.

To help you sell more

"An Invitation to Happier Living" **is a top notch selling book for retail salesmen. The *"Clean-Up" Plan Book* is a complete retail selling activity. For your load-building campaign, the *"Builder-Uppers" Plan Book* provides a human-interest contest every salesman will say is "tops." Write for these helpful books!**

Every house needs

Westinghouse

Westinghouse Electric & Manufacturing Company, Dept. 7169, Mansfield, Ohio.

I want to know all about Westinghouse Range "Kitchen-proved" Performance and Field-tested Selling.

Name_____

Company_____

Address_____

City_____ State_____

advantages of the various wiring changes recommended to increase comfort and convenience in the home.

Seldom are the salesmen successful in obtaining complete electrification of the home, but it has been possible to increase greatly the electrical adequacy of many of the new residences by this means. For instance, the suggestion of a built-in electric bathroom heater has proved one of the most popular of suggestions. Lighting, convenience outlets for clocks and other small devices also are adopted readily.

As well as calling the attention of the owner to electrical adequacy, the load-building scheme also stimulates action for a more complete wiring installation by builders and architects.

Index of Diversity in Range Load

By J. E. BARFIELD
Superintendent of Distribution
St. Joseph Railway, Light, Heat & Power Company, St. Joseph, Mo.

Even a small number of electric ranges scattered through a group of average customers will show an amazingly high diversity between the connected load of a range and its average demand on the distribution system serving it. This conclusion results from analysis of data obtained in simultaneous load records of two adjacent small groups of customers in St. Joseph, one group including a number of range users and the other with none. In passing, it may be remarked that the first set of records taken was discarded because the deductions from the data appeared so startling as to arouse strong suspicion concerning the accuracy of the records. But a second load check produced the same result.

Each group of customers is served by a 7½-kva. transformer. A recording demand meter was installed on each transformer. From the two charts for the week June 25-July 1, 1936, the following information is taken:

	Group No. 1	Group No. 2
Number of customers	38	31
Ranges installed	0	7
Max. demand of group, kw.	6.7	7.2
Energy use per month, kw-hr.	2,052	2,344
Load factor (monthly)	42.5	45.3
Use per customer per month, kw-hr.	54	76
Use per customer per day, kw.-hr.	1.8	2.52
Average demand per customer, watts	176	232

From check meters on a number of installations in St. Joseph a figure of 125 kw.-hr. was established as the average monthly consumption of an electric range. On this basis the seven ranges in group No. 2 used 875 kw.-hr., leaving 1,469 kw.-hr. for the lighting and other appliance consumption of the 31 customers in the group, or 47 kw.-hr. per customer per month. Group No. 1 has an average of 54 kw.-hr. per customer per month and an average demand of 176 watts per customer. Applying to this average demand the ratio obtaining between the average consumptions per customer of the two groups, the following equations are derived for the average and total demands of group No. 2 exclusive of ranges:

$$176 \times 47/54 = 153$$

and $153 \times 31 = 4{,}750$, which is the total demand in watts, exclusive of ranges, for group No. 2. The difference between this figure (4.75 kw.) and the total demand (7.2 kw.) shown by the load record thus represents the additional demand (2.45 kw.) on the transformer due to the seven ranges in the group. Per range, the average increase in demand is then 350 watts. If we consider 7 kw. as the maximum demand of a range, the diversity factor becomes twenty for the seven ranges.

Obviously there is no justification in these limited calculations for the acceptance of twenty as the diversity factor of range load. But there is evidence here permitting the conclusion that the problem of serving ranges in reasonable number from the average well-maintained distribution system may not be so critical as it is often thought to be.

Use Judgment or Be "Judge"d

Reproduced by permission of Judge

Sorely tempted to make some remark about not staring a gift lamp into shame, the editors content themselves with sympathizing with these gentlemen and with pointing out that the lamps are obviously not I.E.S. lamps

PROTECT

WITH L-M LIGHTNING ARRESTERS

Permanent high surge capacity.
Double-sealed against moisture.
Built rugged for long life.
Free from radio interference.

LM

LINE MATERIAL CO.

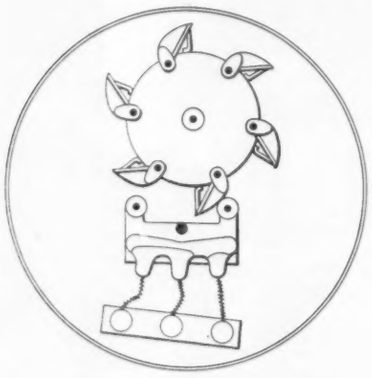
SOUTH MILWAUKEE, WISCONSIN, U. S. A.

New ENGINEERING IDEAS

Discoveries, proposals and developments by electrical engineers and scientists in the field, the factory and the laboratory

Contactor Checks Demand Recorders

Ruggedness and high current capacity are features of a contactor for testing demand recorders which was built and is in use in the meter laboratory of the Dallas (Tex.) Power & Light Company. It will handle enough current so that a number of demand instruments can be checked simultaneously and it may be set for various sequences to simulate load changes.



Contactor for testing demand instruments

The device was made from an old circular chart recording meter from which the electrical parts were removed, leaving only the clock drive. On the clock shaft was fixed a fiber disk as shown in the accompanying sketch. The dogs set around the periphery of the disk are of rather special design. They are of flat spring strip with small props under the free ends. Any prop may be turned in to make the particular cam inoperative. It is by this means that simulations of changing loads are obtained.

The cams on the disk move against the rollers of a rocker arm on which a three-point mercury contactor is mounted. The effect of rotation of the disk is to make alternate contacts between the center and the end terminals of the mercury switch according to the setting of the dogs, thus supplying successive current impulses to the demand recorders under test in the same way as would be done by contacts (at far longer intervals) on the register of a watt-hour meter.

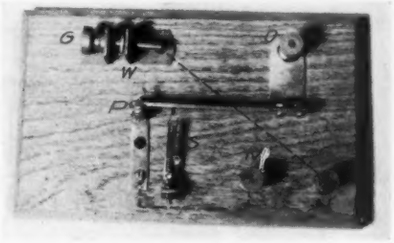
•

Switch Makes Contact at Any Point of Wave

By RAYMOND L. WITZKE
Research Assistant,
Electrical Engineering Department,
State University of Iowa

For initiating operation of any recording or other device at a given point on an alternating-current wave a very simple wave point switch has been constructed and is in operation in the electrical engineering laboratory of the State University of Iowa. Features of the switch are ease of calibration and employment of a non-inductive relay to close the operating circuit.

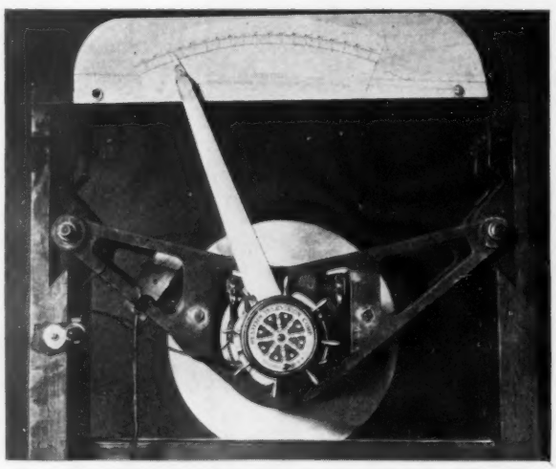
A copper segment is set in the periphery of a disk mounted on the shaft of a small synchronous motor. For each motor revolution the segment makes one contact with a stationary brush, always at the same point on the wave.



Fuse blows, contact closes

The relay consists of a fuse (W) of No. 40 copper wire which holds a contact open against the tension of a spring (S). The gap between the contact points (P) is adjusted (G) to approximately 0.003 in. by pulling up on the fuse wire as appears in the illustration. The fuse wire and the contactor are connected in series with an auxiliary switch across a direct-current supply of 110 volts. When the auxiliary switch is closed the d.c. supply is short circuited through the fuse wire at the first succeeding closure of the synchronous contactor. The fuse blows, the relay contacts are brought together by the released spring tension and the operating circuit is closed on the desired wave point.

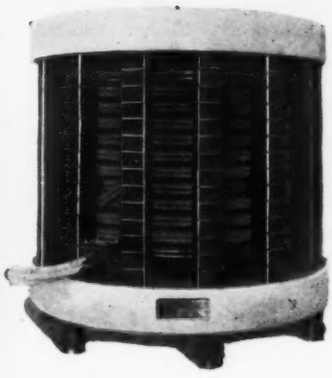
Relay time lag about 0.00046 second, corresponding to approximately 10 deg. on 60 cycles. Lag may be compensated for by advancing the point of contact 10 deg. against the direction of rotation.

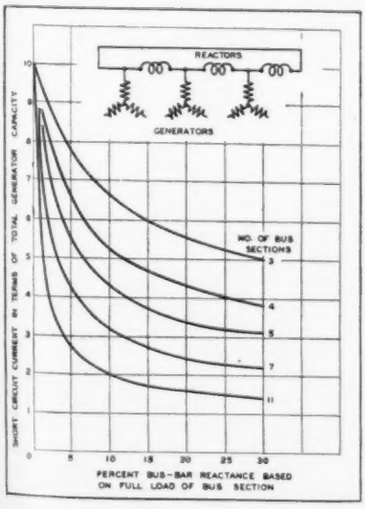


Contact at any point on the wave

Front view of synchronous contactor showing disk and brush, dial with pointer and wheel for rocking motor stator in cradle.

IN DETROIT AS IN MANY OTHER METROPOLITAN AREAS





MURRAY REACTORS

PROTECT DISTRIBUTION SYSTEMS

Here in a few words is what Murray Low Loss Reactors mean to the power plant, for, even if equipment is the last word in the electrical art, they will relieve short circuit stresses and support the continuity of the generator output — promptly, reliably and efficiently.

For the sake of analogy think of the power plant as the ocean shore—the never ending waves as the constant surges on lines and equipment.

And then consider Murray Current Limiting Reactors interposed between your power plant and line disturbances—just as breakwaters protect the shore line.

Reactors in all cases, whether they are generator, bus tie or feeder reactors, should be placed as close to the bus as possible in order to protect the bus under the greatest number of conditions.

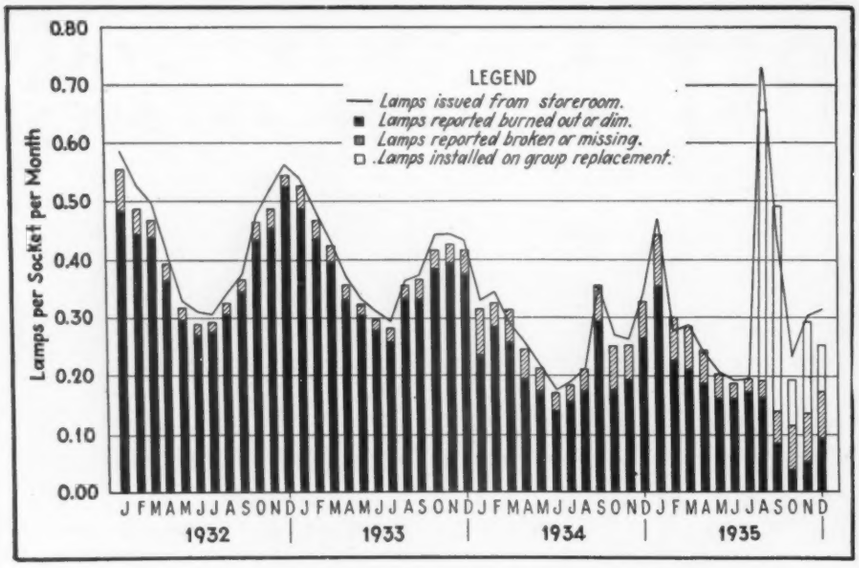
The indoor, **open type bus** reactor illustrated is rated, 1336K.V.A., 4060 amperes, 11.4K.V., 25 cycles. It is completely fireproof.

Diagram shows reduction of bus short circuit current with sectionalizing through insertion of Murray Reactors between sections.

We invite inquiries and request your specifications.

METROPOLITAN DEVICE CORP., BROOKLYN, N.Y.

MURRAY LOW LOSS REACTORS


LEGEND
Lamps issued from storeroom.
Lamps reported burned out or dim.
Lamps reported broken or missing.
Lamps installed on group replacement.
Lamps per Socket per Month
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1932
1933
1934
1935

Annual group replacement of street lamps reduces burn-outs

Long-term performance of multiple lamps—1,500 lumen (100 watts) to 20,000 lumen (1,000 watts). Group replacement was started August, 1935, and completed October, 1935

the alternating-current wave. The point of contact may be varied by shifting the position of the stationary brush or rotating the stator of the synchronous motor.

The zero point on the voltage wave is found by adjusting the stationary brush or the motor frame until zero reading is reached on a d.c. voltmeter in series with the contactor across the synchronous motor supply.

If the synchronous motor is stopped and then restarted, it may pull into step 180 degrees from its former position. This may be checked by placing the d.c. voltmeter in series with the synchronous contactor and the a.c. supply. The meter will read upscale for one phase position of the contactor and downscale for the incorrect phase position.

•

Group Replacement Cuts Lamp Outage

By A. F. REHBERG
Brooklyn Edison Company, Inc.,
Brooklyn, N. Y.

Considerable progress has been made since 1932 in improving the performance of street lamps on the Brooklyn Edison system. A study of the results of changes in lamp design life and the method of replacement indicates that lamp outages can best be controlled by a system of group replacement of lamps at no more than 80 per cent of their design life.

Prior to September, 1933, 1,000-hour, 120-volt general service lamps were used on all multiple street lights with replacement at failure. The operating voltage was higher than the rated voltage of these lamps, and for that reason the burn-out rate was comparatively high for an annual schedule of 4,050 hours. Beginning in September, 1933, 1,500-hour, 120-volt lamps were used to replace the 1,000-hour lamps as they failed. This practice continued until August, 1935, and resulted in an appreciable reduction in the number of burned-out lamps.

Beginning in August, 1935, a group replacement scheme utilizing experimental annual group replacement lamps was adopted for both the 120-volt multiple and 6.6-amp. series street-lighting lamps. Group replacement for the entire system was completed in October, 1935.

The accompanying chart shows the improvement obtained for the multiple street lamps, the number of burned-out lamps per socket per month for the last three months of 1935 being 13.4 per cent as many as in the same months of 1932. Performance of the series group replacement lamps was excellent, the number of burned-out lamps per socket per month being 7.4 per cent as many as in the same months of 1932 and only 25 per cent as many as shown on the chart for multiple lamps.

With the street lamps burning a variable number of hours each day of the year, the annual group replacement eliminates the difficulty of scheduling the replacement of lamps to get about equal burning hours from each lamp. In addition, annual replacement can be combined with a thorough inspection of each lighting unit, which is desirable at that frequency when operating under an annual contract.

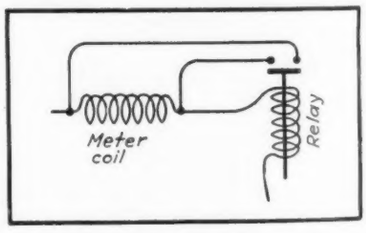
Numerous methods can be used for group replacement, but the most practical method from the standpoint of equipment and personnel is to spread the work over the entire year and replace all lamps in their geographical order. From results during November and December, 1935, with this method it was indicated that three crews with three trucks working five days a week could easily group-replace the 50,000 street and traffic lamps in Brooklyn with the type of lamps in use at that time and also report any defects in the lighting units.

•

No More Bent Pen Arms

Slam against the stop goes the pen of the recording meter when a surge of current gallops through the meter coils. This is not good for the meter. The pen arm may be bent and the calibration thus thrown off. They have a neat little cure for this trouble in the meter department of the Dallas (Tex.) Power & Light Company and it is applied to meters that are to be installed in locations where the danger of heavy current surges can be foreseen.

In the meter is installed a gravity type circuit-closing relay connected in series with the current coil of the meter as shown in the accompanying diagram. The contacts of the relay



Relay shunts current surges out of meter coil

are connected across the current coil. A rush of current closes the relay and short circuits the meter coil and the pen arm does not get a hard enough kick to bang it violently against the stop.

To be sure that the relay will not short out the meter coil on overloads that should be recorded, it is necessary that it be rather carefully adjusted. However, this is not difficult since current surges that might swing the pen too abruptly are considerably greater in magnitude than any reasonable overload.

45 KV. PINTYPE INSULATOR

PORCELAIN PRODUCTS INC. PARKERSBURG, W. VA., U. S. A.

News ABOUT PEOPLE

B. C. Hanks New President of Florida Power & Light

Bryan C. Hanks, whose election to the presidency of Florida Power & Light Company was announced in ELECTRICAL WORLD last week, reached this position after eleven years as head of the legal department of the company and a short term as acting president.

Mr. Hanks went to the Florida organization from the law department of Electric Bond & Share Company in 1925 and was one of the leading figures in getting the $130,000,000 property in Florida properly started upon its corporate existence.

The innumerable operating and legal problems presented by a large scale utility merger of that time were only accentuated by the collapse of the Florida land boom, the devastating hurricanes of 1926 and 1928 and the characteristic difficulties of what was then pioneer territory.

To the young Florida company, which is not yet twelve years old, Mr. Hanks brought an indefatigable energy and personal devotion that contributed greatly to the ability of the company to pass successfully through a severe seven-year panic.

The election of Mr. Hanks to the presidency of Florida Power & Light Company and subsidiaries may well be cited as a symbol of encouragement to the quarter of a million who daily keep the wheels turning in the utility industry.

•

►E. V. CATON, chief engineer and manager of power production, Winnipeg Electric Company, has been elected president of the Association of Professional Engineers of Manitoba.

► DAVIS S. BOYDEN, head of the Boston Edison company's steam heating activities, and J. MILLARD, New England sales representative of the Carrier Engineering Corporation, have been elected directors of the Boston Air Conditioning Bureau.

► V. C. BRUCE WETMORE, district manager of the Wetmore Savage division, Westinghouse Electric Supply Company, Boston, has been elected president of the Collyer Insulated Wire Company, Pawtucket, R. I., succeeding the late Howard W. Fitz. Mr. Wetmore has been vice-president of the Collyer company for eighteen years.

►PROF. ANDRE BLONDEL of Paris, France, has been awarded the Faraday Medal by the council of the British Institution of Electrical Engineers. The medal is given once a year, either for notable scientific or industrial achievement in electrical engineering, or for conspicuous service rendered to the advancement of electrical science.

►PHILLIP ELLIOTT of Flint has been appointed a member of the Michigan Public Utilities Commission by Governor Frank Murphy. He will succeed Harold Waples, resigned.

D. W. Jardine Elected Head of Erie County Utility

David W. Jardine, vice-president and general manager of the Erie County Electric Company, Erie, Pa., has been elected president of that company to succeed the late Charles H. Strong.

A graduate of Lehigh University, Mr. Jardine became associated with the American Gas Company in 1907. During this connection he was in charge of the construction of the electric plant at Waukesha, Wis., and later was placed in charge of electric and gas operations at Waterloo, Iowa, and Burlington, Vermont.

In 1928 he resigned as manager of the Burlington Light & Power Company to become vice-president of the Philadelphia Suburban-Counties Gas & Electric Company. It was in 1930 that he was made vice-president and general manager of the Erie County Electric Company.

•

►HAROLD A. OLSON, who has served as assistant manager of the Buckeye division of the Incandescent Lamp Department of General Electric Company in Cleveland, has been appointed

YUH KNO', FRED,
THE CHIEF WAS AFRAID
THIS EMERGENCY WORK
WOULD COME TO A FULL
STOP ON ACCOUNT OF
CONDUIT DELIVERY....
..BUT THESE ORANGEBURG
DISTRIBUTORS SURE
KNOW THEIR STUFF....
...HERE 'TIS...AND.....
.....
ORANGEBURG
THE FIBRE CONDUIT CO.
ORANGEBURG-N.Y.
SALES AGENTS
GRAYBAR ELECTRIC CO.
GENERAL ELECTRIC SUPPLY CORP.
FULL STOP
YOU SAID IT

manager of the company's north Pacific division at Portland, Ore. He will fill a vacancy occasioned by the sudden death of J. F. Reinke. Mr. Olson entered the employ of General Electric at Nela Park in 1916.

▶M. P. THIEL of Chicago has been appointed general sales manager of the electrical division of the McGill Manufacturing Company, Valparaiso, Ind., to succeed Charles S. McGill, who will devote his time to other interests of the company. Mr. Thiel has been associated for many years with the electrical supply business. For the past sixteen years he has been connected with Doherty-Hafner Company, the Chicago district representative of the McGill Manufacturing Company. He was transferred to the factory in Valparaiso last July to prepare for his new duties.

▶C. W. STANBROUGH, who has handled advertising and sales promotion for the Kansas City Power & Light Company since last May, has been appointed to develop and direct a new company promotional activity, wherein the company will play a larger part in the promotion of all phases of the electrical industry in co-operation with electrical dealers, contractors, builders and others interested in the sale of electrical appliances and equipment. Mr. Stanbrough has been identified with Kansas City Power & Light since 1933. In addition to handling advertising and sales promotion, he has been for more than three years editor of the company publication, *Power & Light News*.

Gaylord B. Buck Presides at Colorado League Meeting

Gaylord B. Buck, general commercial manager of the Public Service Company of Colorado, presided at the first regular luncheon-meeting of the new year of the Electrical League of

Colorado held last month at the Denver Athletic Club. Though long a member of the official family of the league, Mr. Buck has never been the presiding head until this year.

He was elected president at the annual meeting held in December to succeed E. E. Brazier, who served two terms. While head of the Rocky Mountain Electrical Association, Mr. Buck was instrumental in developing the co-operative program which functions throughout the year on continuous electrical merchandising activities.

George E. Lewis was appointed manager of the league by the board. He had been acting manager since June.

"LIGHT HIGHWAYS AND SAVE LIVES"—This was the message of President G. Bertram Regar of the Illuminating Engineering Society to 200 members and guests of the New England section at a recent meeting welcoming the national head of the organization to the Hub. Left to right: Julius Daniels, assistant head commercial bureau, Boston Edison Company; R. S. Bolan, formerly chief engineer Hygrade Sylvania Corporation and now connected with the Carlton Lamp Company, Union City, N. J., besides being chairman of the New England section; President Regar, and Miss M. Richardson of Boston Edison.

•

▶WILLIAM A. WHITTLESEY, vice-president and for many years general manager of the Pittsfield (Mass.) Electric Company, has been elected president of that utility. GEORGE W. LAWRENCE, formerly president, has been made chairman of the board, and W. RODMAN PEABODY, vice-president, has been made vice-chairman. The company is one of the Western Massachusetts Companies group.

OBITUARY

▶ISAAC W. WALKER, an executive in the Thomas A. Edison Industries, Inc., for a number of years, died February 1 at his home in Orange, N. J. His age was 66. Mr. Walker was a member of the Edison Pioneers.

▶PHILLIPS B. SHAW, who was formerly associated with Thomas A. Edison, died in Philadelphia January 31 in his ninetieth year. During his association with Mr. Edison, Mr. Shaw organized and directed the financing of many electric light and power plants in Pennsylvania.

▶JOSEPH N. VACCA, senior engineer of the Public Utilities Commission of New Jersey, died January 9 at his home in Newark, after a brief illness. Mr. Vacca had been on the commission for 23 years. He was 48 years old.

▶JOHN W. PURCELL, an engineer on the Ontario Hydro-Electric Power Commission for 25 years, died January 6 in Toronto, in his sixty-fifth year. Associated with the late Sir Adam Beck in the early days of the commission, he had been active in introducing electricity to the farms of Ontario. Mr. Purcell was a member of the Canadian Society of Engineers.

▶DR. JOHN B. TAYLOR, assistant to Dr. Irving Langmuir in the Research Laboratory of the General Electric Company, died in Schenectady, N. Y., January 22, after a short illness. Dr. Taylor had been a member of the Research Laboratory staff since 1929. He was born in Chicago, Ill., in 1900 and received his education at the University of Illinois.

HERE'S ANOTHER ENDORSEMENT OF

Kelvinator's great 1937 program!

ORDERS FOR KELVINATOR REFRIGERATORS IN 1937 HAVE ALREADY SHATTERED ALL PREVIOUS RECORDS!

THE FINEST LINE OF REFRIGERATORS KELVINATOR HAS EVER BUILT

That's how the field organization feels about the great Kelvinator programs for 1937.

Right down the line—distributors, dealers and salesmen—are more enthusiastic than they have ever been before at the start of a selling season. They are enthusiastic about the new product, the advertising, the promotion, and the selling story.

And they voiced this enthusiasm with *orders*—orders far in excess of those ever turned in, in previous years, following the announcement of a program.

KELVINATOR, *Division of Nash-Kelvinator Corp., Detroit*

PROMOTION THAT GUARANTEES FLOOR TRAFFIC

THE LARGEST NATIONAL ADVERTISING CAMPAIGN IN KELVINATOR'S HISTORY

COAST-TO-COAST RADIO CAMPAIGN

THE MOST CONVINCING SELLING STORY EVER PUT BEHIND A REFRIGERATOR

1937 will be the greatest year in history for

Kelvinator Dealers

Manufacturing AND MARKETS

Water Heater Drive Program Completed

Plans have been completed by the Edison Electric Institute and the electric water heating section of the National Electrical Manufacturers Association for an intensive promotion program to obtain broader public acceptance of electric water heating in 1937.

K. M. Robinson, president of the Idaho Power Company and chairman of the E.E.I. water heating committee, is heading this joint activity. Manufacturers co-operating are: Automatic Electric Heater Company, Clark Electric Water Heater Division of the McGraw Electric Company, the Cleveland Heater Company, Edison General Electric Appliance Company, Inc., Electromaster, Inc., A. J. Lindemann & Hoverson Company, Westinghouse Electric & Manufacturing Company, John Wood Manufacturing Company, the Hotstream Heater Company, Malleable Iron Range Company and Thermogray Company.

•

Government Agencies Award More Equipment Contracts

Among the contracts for electrical equipment awarded by federal agencies, according to an announcement made by the Labor Department this week, are the following:

International Nickel Company, Inc., the Navy, copper-nickel-alloy, $36,995.87; Westinghouse Electric & Manufacturing Company, Bloomfield, N. J., Navy, triodes, $15,810; Okonite Company, Passaic, N. J., Navy, cable, electric, $189,321.30.

•

Applies for 500,000 Watts

Application for an increase in power from 50,000 to 500,000 watts for WBZ, Boston, pioneer radio station of New England, has been filed by its owner, Westinghouse Electric & Manufacturing Company, with the Federal Communications Commission at Washington, D. C. WBZ is the Boston outlet of the National Broadcasting Company blue network.

•

G.E. Pays Over $1,000,000 Under Group Insurance Plan

Death and disability claim payments to beneficiaries of employees of the General Electric Company amounted to more than $1,000,000 during 1936, according to the annual report of W. W. Trench, secretary of the company. Since the group life insurance plan of the company was established in 1920, more than $13,000,000 has been paid out in claims.

•

Sales Meetings Scheduled

Predicting the biggest increase in commercial refrigeration sales that the industry has known, J. A. Harlan, commercial manager for the Kelvinator Division of the Nash-Kelvinator Corporation, announced recently a series of sales conferences to be conducted in eleven cities throughout the country. More orders for Kelvinator commercial equipment were booked during the first week of January this year than during the entire month of January a year ago, Mr. Harlan stated.

•

Standardizes Mill Motors

Electrical drives even for large power requirements have been developed to the extent that they are rapidly becoming standardized. For example, Westinghouse has built 32 identical steel mill motors rated at 1,250 hp., 600 volts, 300/600 r.p.m. Installed in four different steel manufacturers' plants, each is used for driving cold strip or sheet mills.

New Building Opened by General Electric

Alterations on the old porcelain plant of the General Electric Company are under way preparatory to reopening the building about June 15 for the use of the plastics department. These alterations will give 77,000 ft. of floor space to the division for manufacture of distribution transformers. The change will also give the plastic department 100,000 sq.ft.

It was reported that all departments of the works are busy and that approximately 6,500 are employed.

As part of a general expansion program General Electric has transferred the washing machine division into the recently acquired factory buildings in Bridgeport, Conn. The six buildings acquired from the Remington Arms Company, Inc., will give the washing machine division 100,000 of the 250,000 sq.ft. of floor space.

Both parts-making and assembly units will be included in the division, making it one of the largest washing machine manufacturing plants in the East. It is expected that two months will be required to modernize the buildings and another month to complete installation of machinery.

•

Use Telechron Radio Timer To Increase Receiver Sales

A method of increasing sales per customer, which apparently can be extended to many lines of specialty selling, it is said, is being used by the Warren Telechron Company of Ashland, Mass., electric clock manufacturers.

One of the company's dealers reports that he has obtained 80 per cent acceptance from buyers of his radios for an additional sale by including a Telechron radio timer clock as part of the complete sale. Whenever pros-

In HIGH TENSION EQUIPMENT..

whether your present need is a few bus bar supports, or the complete equipment for some new substations, whether your equipment is to be standard or built to your own specifications, it will pay you to talk over your needs with your L-M representative.

Here Is Why • L-M High Tension Equipment is designed by engineers who are thoroughly familiar with utility operation. The standard L-M High Tension line is complete . . . and from bus bar supports to gang operated air brake switches is built to N.E.M.A. standards. In addition, L-M builds special high tension equipment to your own specifications. You can depend on L-M for prompt delivery, low maintenance and long service life. Write to South Milwaukee, Wisconsin, for your copy of the L-M High Tension Catalog, Number 36-1.

LINE MATERIAL CO.

pects ask for a home demonstration of the radio set the dealer delivers the receiver plus the timer with a brief leaflet and instruction. It was reported that 80 per cent of the buyers of the radio also took the clock.

•

California Edison Awards Line Equipment Contracts

Southern California Edison Company has awarded three contracts for transmission line equipment for the 165,000-volt line from Boulder power plant of the federal government, Boulder Dam, to company power substation at Chino, Calif., as follows:

Steel towers, about 6,500 tons, to Bethlehem Steel Company, Bethlehem, Pa.; steel-reinforced aluminum conductor, about 700 miles to Aluminum Company of America, Inc., Pittsburgh, Pa.; ground wire 460 miles, one-half to Joslyn Company of California and one-half to Pacific Wire Rope Company both Los Angeles. The proposed line will be 238 miles long and is estimated to cost close to $3,750,000.

•

Another Trade Show at Hub

For the fourth year the Electrical Manufacturers' Representatives Club of New England will hold a merchandise, equipment and machinery show in Boston, the dates being March 3-5 and the locale the Hotel Bradford. More than 100 display booths will exhibit the products of some 400 manufacturers of electrical supplies and apparatus, and many factory engineers and executives will attend. R. P. Taylor, 93 Federal Street, Boston, is club president, and Charles A. Stone, 176 Federal Street, Boston, is trade show secretary.

•

Advertising Budget Up

General Household Utilities Company is to increase its appropriation from 40 to 50 per cent over last year in advertising its 1937 line. The six models feature the standardized mechanical units of 16-lb. ice capacity and a circulating air filter system for eliminating food odors and maintaining even temperatures throughout.

New York Metal Prices

	Feb. 3, 1937 Cents per Pound	Feb. 9, 1937 Cents per Pound
Copper electrolytic	13.00*	13.00*
Lead Am. S. & R. price	6.00	6.00
Antimony	14.25	14.25
Nickel ingot	35.00	35.00
Zinc spot	6.35	6.60†
Tin Straits	50.60	50.375
Aluminum, 99 per cent	19—20	19—20

* Delivered Connecticut Valley † Nominal

Field Reports on Business

Demand for equipment to rebuild the areas stricken by the flood has brought rush orders to electrical manufacturers. Utility purchases are higher than last year, with line materials featuring due to the outside construction which is under way because of the unusually open winter. Orders for lighting equipment—both store and street—are being received in good volume. Electrical appliances are moving steadily in all sections of the country.

NEW ENGLAND

New England area is continuing to buy electrical supplies at a rate slightly over that for last year. Heavy electrical machinery specifications are now being studied in connection with power generation expansions. Small motor sales show an encouraging trend and orders are holding up well. A steady to strong tone in machinery and machine tool industries in central Massachusetts and Rhode Island has greatly benefited small motor and switch apparatus sales, according to one prominent representative.

Central station supplies are moving at a good pace. Due to the unusually open weather, line repairs and outside construction have been carried along, and small lot orders for line materials have been more numerous than at this time last year. Distribution transformer sales for the past month were ahead of last year, according to one manufacturer. Some special electrical apparatus has been receiving a good deal of attention. Electrical supplies for intercommunication lines for marine service and for institutions are among leading items of interest. Electrically operated fire-alarm systems are engaging attention.

Interior electric lighting and special illumination for store-front displays are active. Inquiries for commercial electric service and negotiations for electric cooking applianes for institutions are being received in good volume. House wiring and street lighting equipment are involved in a large home modernization project in Chicopee Falls, Mass., where renovation in a large district will provide for 205 modern homes. The meter department of the General Electric Company, Lynn, Mass., has received orders to run overtime in order to get out 60,000 meters for the flood region. Similar emergency activity is reported in the transformer division of this company at Pittsfield, Mass.

CHICAGO

Receding floodwaters in the Ohio Valley have brought a large volume of orders for material and equipment necessary in the process of rehabilitation. With transportation restored, large shipments are now being sent into the blighted area and virtually every electrical manufacturer has received rush orders for equipment.

Reports from the various branches of the electrical industry in the Chicago area reflect favorable business conditions. Electric energy output for this district dropped slightly last week, but was still far above the level of a year ago. Utility purchases are higher than last year and should increase greatly when plans now under consideration are approved. Appliance sales are steady, with washers and ironers especially active. Orders for lighting equipment are being received in good volume. One manufacturer is continually enlarging his organization to meet the increased demands for equipment. Electrical wholesalers report a 41 per cent. increase in sales for December over November. Sales for the year 1936 were 47 per cent. above 1935.

The city is receiving bids on 227,300 ft. of 5,000-volt rubber-insulated, lead-sheathed cable, 33,000 lb. No. 6 weatherproof line wire, 14,400 lb. ⅝in. stranded bronze wire. The P.W.A. last week awarded contracts for electrical work in three schools amounting to $37,773.

NEW YORK

Electrical appliance sales in January were unusually good, preliminary reports show. Stocks were depleted as a result of the heavy Christmas buying and wholesalers and retailers are now replenishing their supplies, with the result that January, usually a dull month, proved quite active. Retail sales in the first week of February have led merchants to hope that store volumes will show a larger increase this month over 1936 than January, although February has one less Saturday than last year.

Steel operations this week are scheduled at 80.6 per cent of capacity, according to the American Iron and Steel Institute. This current figure equals the 1937 high level of January 18.

PACIFIC COAST

Wholesalers report very good orders from ship outfitters, 22 ships being loaded in San Francisco alone on the end of the strike. Coast arrival of about as many cargoes prevents a general price advance averaging 10 per cent because of higher freights. However, all lines have advanced at least as much during the past 60 days from increased factory costs.

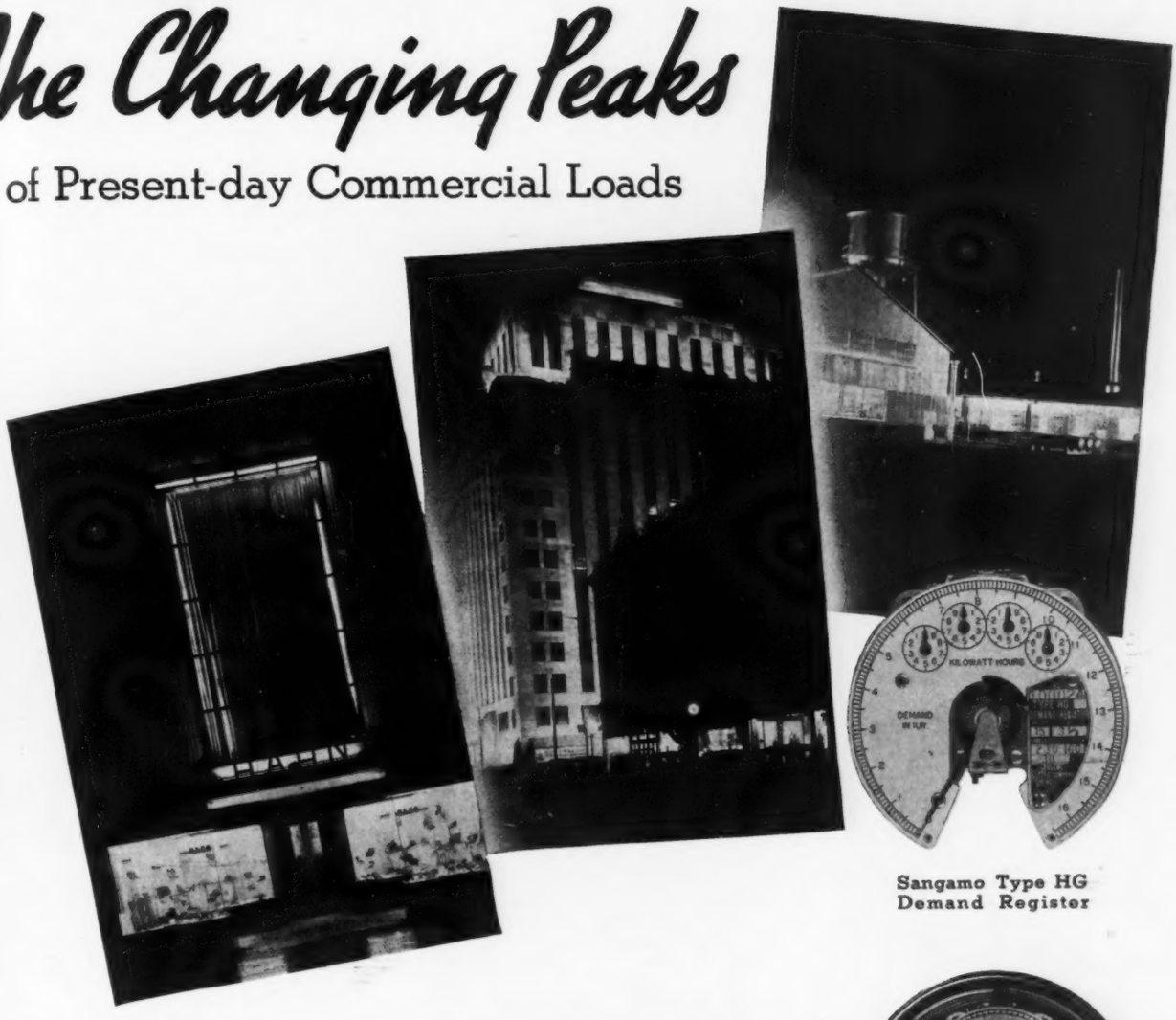
Electrical machinery orders continue excellent. Outstanding is a 3,500-kva. turbine, valued at $110,000, bought by the Pacific Gas & Electric Company to use up the surplus steam generated in its Oakland plant by the new $700,000 equipment recently installed. Other orders include a $10,000 cable dredging outfit, a $40,000 rectifier installation for a chemical works and a $20,000 stock order for pumping motors ranging from 3 to 100 hp. Power companies are buying heavily of distributing transformers averaging 37½ kva., with bulk of them destined for lower San Joaquin Valley.

Major P.W.A. applications include $1,841,950 for power plant in Tuolumne County to handle West Stanislaus irrigation district and a $1,160,175 school program for San Francisco, the grant in each case being about 50 per cent of the total. A recent order covers a $10,000 photo-electric protective system for cable anchorages of Bay Bridge. Hospitals feature building reports, the jobs averaging $100,000 for additions or smaller units.

Power company purchases are good, though exceeded by value of bids for the year's requirements of poles and crossarms not yet awarded.

The Changing Peaks

of Present-day Commercial Loads



Sangamo Type HG
Demand Register

Need Modern Demand Meters

Electrical modernization in stores, offices and factories has accomplished much in the upward trend of commercial loads. Each change affects the peak, so that the necessity for measured demand is definitely increased.

An accurate and reliable method of metering demand is offered with Sangamo Type HG Demand Registers. These registers are interchangeable on Sangamo Singlephase Watthour Meters and the modern two-element single-disk type L-2 Meters.

Bulletin No. 88 contains the detailed description of Type HG Demand Registers for all alternating current meters.

HG Demand Register on the
two-element single-disk
Type L-2-A Meter.

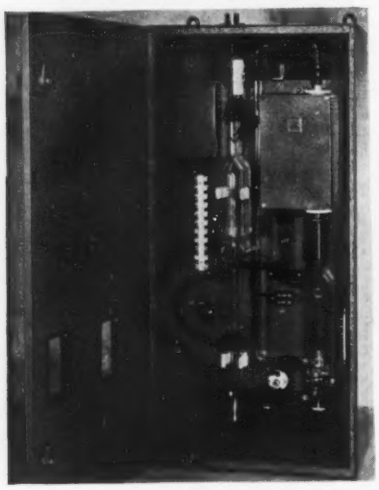
SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

New EQUIPMENT AVAILABLE

CO_2 Analyzer

New CO_2 recording equipment utilizes thermal conductivity principle of measurement and is composed of four complete units—recorder, gas analysis cell cabinet (pictured), primary filter and sampling



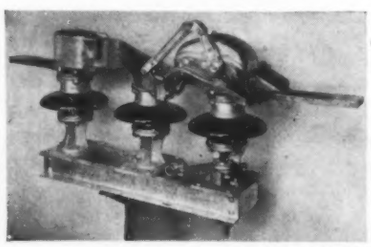
Wet gas CO_2 recording equipment; gas analysis cell cabinet pictured; range, 0 to 20 per cent CO_2; for operation on 110-volt, 60-cycle a.c. **Leeds & Northrup Co.**, Philadelphia, Pa.

line. Cell cabinet is mounted near the point of sampling and connected by means of a lead lined iron pipe and fittings to primary filter mounted in the boiler. Recorder is mounted wherever desired and connected to cell cabinet with ordinary copper wire. Power is obtained by connecting recorder to ordinary light source. By means of aspirator on cell cabinet a continuous sample of gas is drawn from boiler to gas analysis cell.

•

Low-Voltage Switch

Only 80 ft.lb. effort is required to operate this recently announced switch, it is



Rating 2,000 amp., 15 kv.; units are 48 in. long, weigh 400 lb. per single pole. **Hi-Voltage Equipment Co.**, Cleveland, Ohio.

claimed. Fully inclosed, all bronze operating mechanism controls straight line motion into and out of self-aligning silver-faced contacts, and also swing of switch arm to full open position. Entire mechanism is mounted on monel ball bearings and graphite insert bearings. Clearances, gap spacings and flashover values are said to conform to N.E.M.A. standards.

•

Traffic-Signal Controller

As many as sixteen cycle positions and as many as fifteen signal-light circuits may be controlled with a recently announced traffic-signal controller, it is claimed. It

Novalux, Type D. **General Electric Co.**, Schenectady, N. Y.

comprises a 6-watt Telechron motor, a rotating dial, a timer drum with the necessary signal contacts—which are silver and are said to be capable of carrying a 10-amp. load—a panel with three snap switches and an integral base casting. Traffic-cycle length may be varied from 40 to 180 seconds by means of gear changes within the timer, five changes being provided with each unit.

•

Multi-Notch Drum Controls

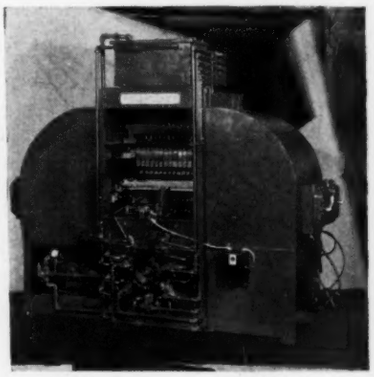
Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

By making changes on railway drum controllers, involving adding a new controller drum and resistor, it is claimed that many of the advantages of modern multi-notch control can be obtained on older cars, thereby producing smooth acceleration at all rates.

Thus Types K-35 and K-43 controllers may be changed to have 22 steps instead of 8; similar changes can be made on most other types, it is said.

Multiple Spot Welder

This automatic, multiple spot welding machine has four transformers and a series of hydraulic plungers which actuate in rotation to make a number of welds. It also



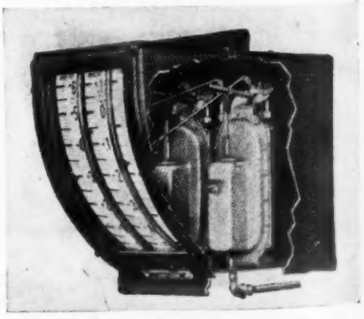
"Multi-Spotmatic." **Thomson-Gibb Electric Welding Co.**, Lynn, Mass.

has a special work-carrying table and an indexing arrangement so that rows of spot welds may be made at fixed positions across the work. Feature of machine is rotary control valve located at lower center of front of machine. It controls the pressure and duration of current flow for each individual weld and permits variation in thickness of metal being welded, it is said.

•

Multi-Pointer Gage

A new diaphragm material, said to be resistant to oil, acid, caustic and heat, is the outstanding feature of recently developed, diaphragm-operated, multi-pointer gages for boiler room service in measuring drafts, pressures and differentials. Pressure applied on left side of diaphragm facing calibrated spring causes movement of sys-



Multi-pointer gage; available in castings containing one to twelve units. **Bailey Meter Co.**, Cleveland, Ohio.

A Welcome Improvement in INDUSTRIAL LIGHTING

400-Watt Type-H1 Mercury and 750-Watt Mazda Lamps in alternate lighting units provide excellent seeing conditions in this assembly department.

More uniform production, less eye-strain at the end of the day, and cheerful, pleasant working conditions are immediate results of the use of the higher levels of illumination which can be provided by combinations of the new General Electric Mercury Lamps and Mazda incandescent lamps. The mercury and incandescent lamps can be combined either in one reflector or mounted at alternate outlets.

When the light of mercury and incandescent lamps is blended in equal parts a simulation of daylight is obtained, which blends very well with natural light. With the higher levels of illumination now obtainable, production can be materially stepped up and "rejects" held to a minimum.

Details on this modern illumination are available on request from either address.

The 400-Watt Mercury Lamp is 60 to 140% more efficient than other available light sources. It burns vertically only.

By combining Mercury and Incandescent Lamps in many conventional type luminaires, a psychologically cool, white light can be obtained.

GENERAL ELECTRIC

797H

General Electric Vapor Lamp Co.
805 Adams Street, Hoboken, N. J.

Incandescent Lamp Department
Dept. 165, Nela Park, Cleveland, Ohio

Order your auxiliary devices which were designed especially for this lamp from the General Electric Vapor Lamp Co.

tem to left. Motion is opposed by calibrated spring and is transmitted by sealed link to outside of diaphragm unit, where drive link carries motion to indicating pointer.

•

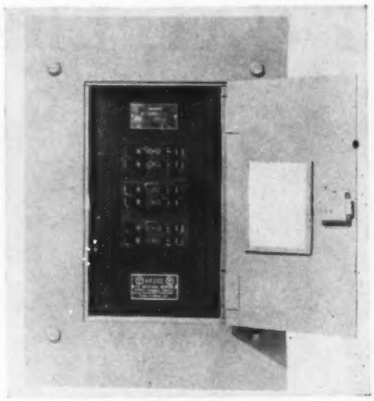
Circuit Recloser

Addition of a 4-amp. unit completes this company's line of automatic oil circuit reclosers, which now will operate on currents up to 50 amp., with voltages from 2,200 to 7,500. Recloser is normally closed in service, opens circuit when line fault occurs and recloses after three-second interval. If fault has not cleared, circuit is reopened. Adjustment may be made for one, two or three reclosures, with time interval of three seconds between operations. If fault is still on line after last reclosure, device locks open and must be reset manually.

Type FP-19, in closed position; 4-amp. rated current, 15-amp. minimum tripping current. **General Electric Co.**, Schenectady, N. Y.

Panelboard

A new low-cost "Nofuze" panelboard offered, is said to be particularly suited for application in industrial plants, buildings, hotels and all types of commercial structures. Using the multi-breaker units recently developed for load centers, its compact design is said to permit its installation in spaces where other panels might not be used, such as the face of columns. Bus arrangements for single-phase, three- and two-wire and three-phase, four-wire services are provided.

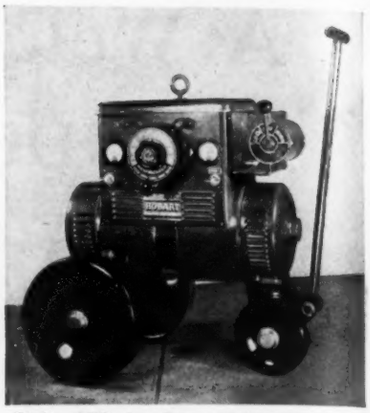


For 115, 115/230 volts a.c. distribution in a range of 4 to 40 circuits in two-circuit steps; branch circuits ranging from 15 to 50 amp. available. **Westinghouse Electric & Manufacturing Co.**, East Pittsburgh, Pa.

•

Arc Welder

This is said to be the first arc-welding set equipped with control of the electric motor as well as of the generator. What is termed as "selective motor horsepower control" is simply operated; convenient latch locks handle in "Low" position, where only half rated motor horsepower is used for starting and for welding up to one-half rated generator capacity in continuous manual arc welding (up to two-thirds rated capacity for intermittent welding). When it is desired to operate at higher rates a lever releases handle for turning to "High," where rated horsepower of motor is available for full load and overload welding.

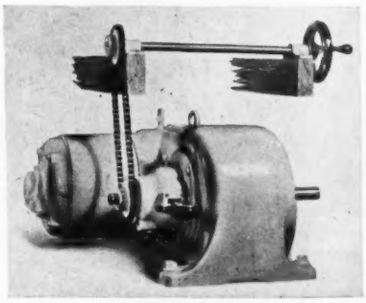


Series MN; in sizes ranging from 75 amp., 1½ to 3 hp. to 600 amp., 20 to 40 hp. **Hobart Bros.**, Troy, Ohio.

•

Remote Speed Control

New line of standardized parts for obtaining remote mechanical control of this company's "Varidrive" motor has been developed. Bearing supports, shafting, sprockets and chains have been standardized so user can obtain variation of speed on driven machine conveniently and economically, the manufacturer states.



For Varidrive motors from ¼ to 15 hp. **U. S. Electrical Motors, Inc.**, Los Angeles, Calif.

•

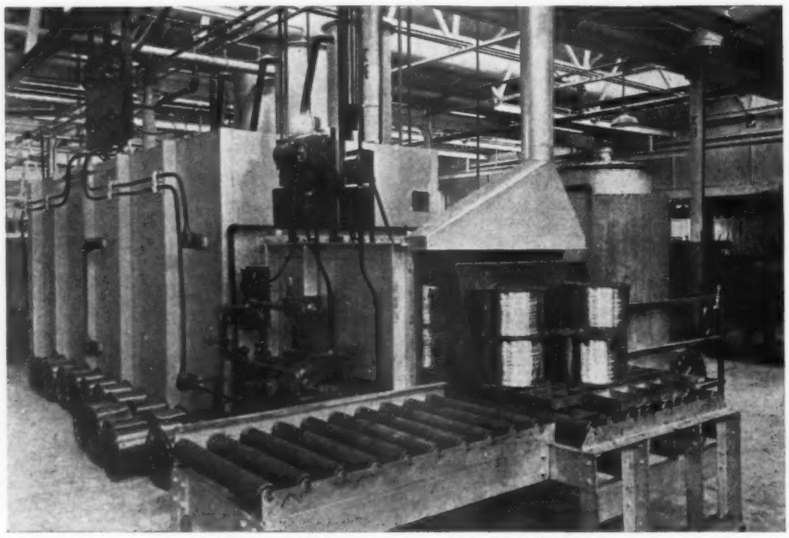
Cable End Seal

New design of cable end seal consists essentially of copper terminal lug—solder or solderless style—with gasketed flange, bakelite insulator, "Resistoyl" sealing bushing and brass packing nut. Claimed advantages include small over-all size, ease of installation and low cost; it is said to prevent leakage of impregnating oil from cable end.

Type "FT"; particularly intended for use on paper-insulated, lead-covered cables up to 500,000 circ.mil, 600 volts. **G & W Electric Specialty Co.**, Chicago.

Electric Furnace

Here is a continuous, special atmosphere electric furnace recently developed and installed for bright annealing copper wire. Heavy cast nickel-chromium alloy, grids located in roof and bottom of heating chamber, serve as heating elements, which are divided into two separate and automatically controlled zones. Furnace is said to differ from some of older types in that no water seals or vapor of any kind are used in this equipment and thus wire is dry at all times. Special atmosphere required for bright annealing is provided by gas generator at side of furnace.



Rated at 100 kw., designed to operate at temperatures ranging from 700 to 1,000 deg. F. **Electric Furnace Co.**, Salem, Ohio.

A.I.E.E. Talks Performance

[*Continued from page 44*]

pletely divorced from the dust-collecting function. Myron Zucker of Detroit asked and was informed that the precipitator in the author's home for three years handled 900 cu.ft. of air per minute on 6 to 7 watts actual precipitation and ionization energy, 10 watts each for tube and transfer loss and 40 watts for the fan. R. E. Hellmund (Westinghouse) said there are 20,000,000 people in this country suffering from an allergic supersentiveness to food or inhalation factors and only a small percentage are affected by substances other than those conveyed by the air. Dust and pollen, in addition to causing allergic conditions in themselves, are quite generally assumed to carry bacteria and, therefore, their elimination by precipitator may lessen the danger of propagation of infections caused by germ-laden air.

Meter ratings discussed

Two papers on watt-hour meters at the measurements session brought out the question about giving the future long-range watt-hour meter a nominal current or wattage rating. One paper by Kinnard and Trekell (General Electric) summarized the evolution of the design of modern watt-hour meters in such form as to "smoke out" the limitations to performance and thus show where progress has been and can be made. The culmination rests in a new design of watt-hour meter. It is nominally a 12.5-amp. meter but with better light load performance than the old 5 and better at 60 amp. than the old 15.

This scope caused H. B. Brooks of the Bureau of Standards to ask what would be the value of calibration loads to represent present light load and full load requirements. Prof. W. B. Kouwenhoven proposed that the A.I.E.E. committee on instruments and measurements take jurisdiction to initiate the discussion on standardized ratings and test points for the new meter and its mates. To A. J. Allen (New York Edison) the announcement of the new range wipes the 5-amp. unit out of the 5-, 15-, 50-amp. setup of N.E.L.A. in 1930 when the 10 and 25 started for the discard. However, with the present high percentage of 5-amp. meters in service, growth in load may before long necessitate a large-scale rebuilding

When Power Is Interrupted

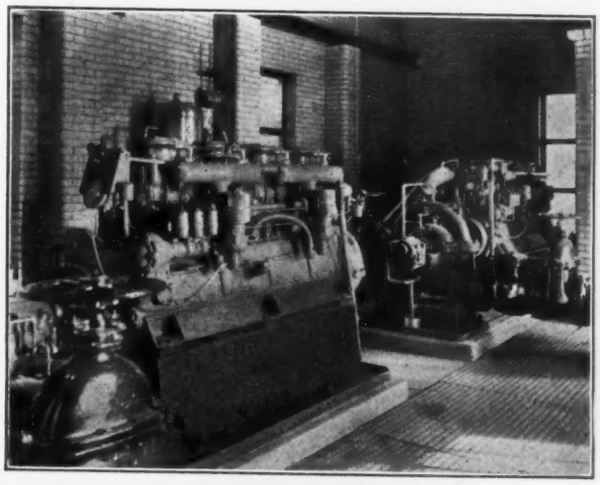
LIGHTS GO OUT . . . .

WATER FLOW STOPS

STERLING HIGH DUTY INTERNAL COMBUSTION ENGINES

Sterling engines were developed to pump water in any emergency. The details of their design and installation in your water works are scientifically developed. Informed engineers are at your service.

STERLING ENGINES—*for peak load and standby*
GAS—GASOLINE—OIL ENGINES



The emergency pumping station of the Portland, Maine Water District consists of 2 Sterling Dolphin C-8 cyclinder 240 H.P. engines driving 2 Warren centrifugal pumps at 1250 R.P.M.

STERLING ENGINE COMPANY

Home Office and Plant
1270 Niagara Street
Buffalo, New York

Dept. C-2

Branch Office
900 Chrysler Bldg.
New York, N. Y.

This photograph was taken in our studio in duplicate of a hook-up in actual use and is one of the heaviest in the U. S. A. Details supplied on request The Brewer-Titchener Corp.

Hardware Used

BTC Drop Forged Releasing Clamps
BTC Drop Forged No. 3001 Hooks
BTC Drop Forged Caps

For uniform metal
For added strength
For dependable lines
Specify Drop Forgings

If it's Hi-Line Hardware - it's in this Book

. . . Sold through Your Insulator Mfr. Only

The Brewer-Titchener Corp.
Cortland, New York

program to conserve the heavy investment in otherwise adequate meters.

Whether we are ready to abandon all volt-ampere designations of meter rating and simply have a domestic, a commercial and a power meter is something F. C. Holtz (Sangamo) is not ready to admit.

The second paper, by Kinnard & Goss, treated the theory and practice of meter bearings and showed how the meter just described gains some of its range of accuracy by use of a cobalt-tungsten pivot on a sapphire jewel. No iron is present to form an abrasive red oxide of iron.

Here F. C. Holtz interjected by letter that the prevailing steel pivot with appropriate lubrication may have no more wear than the alloy pivot described in the paper. To him, osmium, iridium and platinum show great promise as pivot materials. A. J. Allen's comment was that the outdoor meter has intensified the need for a non-corrodable pivot if long, light load accuracy is to be attained. A. R. Rutter (Westinghouse) reminded the audience that the familiar ball type of bearing acts like an infinite number of pivots and, employing rolling action, needs no lubrication to avert wear and minimize friction.

Pumped vs. sealed ignitrons for welding control

Discussion of Packard and Hutching's paper on sealed-off ignitrons for welding control at the electronics session on Wednesday brought out clearly the fact that selection of pumped vacuum or sealed vacuum ignitron tubes for welding control is an economic question influenced by the duty cycle of the welder and its size. R. E. Hellmund (Westinghouse Electric & Manufacturing Company) pointed out that with the sealed ignitron life was limited, while with the pumped ignitron, while more expensive in first cost, life was indefinite. He predicted that within a few years the sizes of welders that should use pumped ignitron tubes and those that should economically use sealed tubes would be well established. W. C. White (General Electric Company) showed that there was no competition between the pumped and sealed ignitron tube and that the choice between them was entirely economic in nature. It was reported in the discussion of this paper that there were 400 to 500 sealed ignitron tubes in service and that little trouble

and few failures had been experienced that had not developed soon after installation and been traced to minor manufacturing faults.

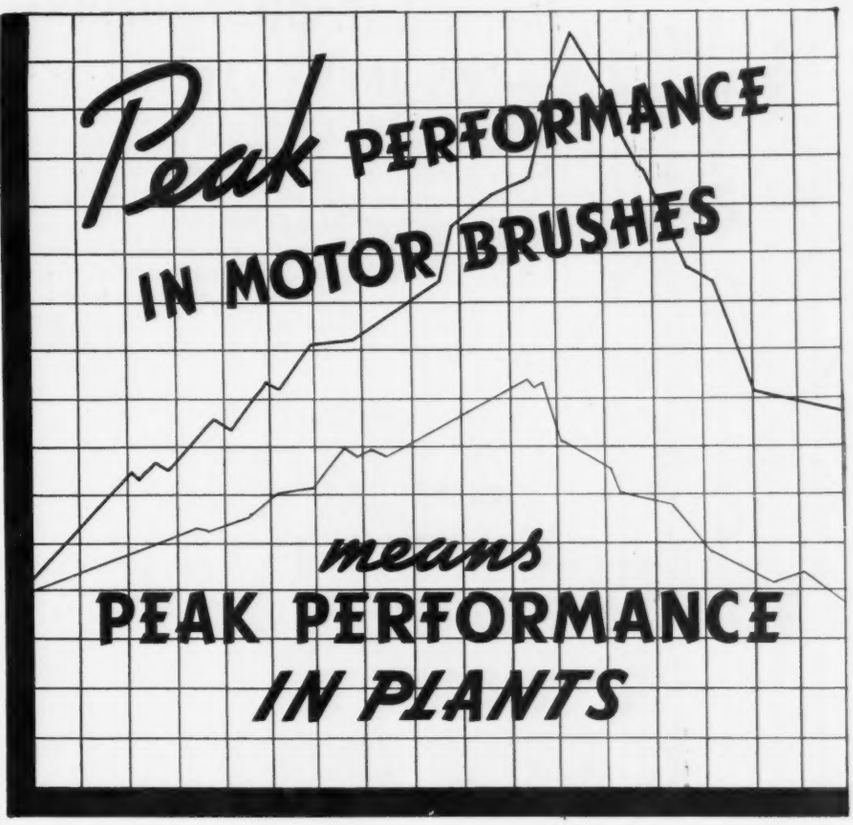
The fact that the electronic regulator for d.c. generators described in F. H. Gulliksen's paper could not as yet be adapted to use on a.c. generators was brought out in discussion by Mr. Ballard of the American Research Council. Gulliksen reported that no tubes are yet available to handle the currents that would be encountered in regulating the a.c. machines. Reply to questions by E. E. George (Tennessee Electric Power Company) indicated that these regulators can be used on d.c. generators operating in parallel without excessive loss of regulation.

New arc theory advanced

An unpublished paper on fundamental phenomena of the electric arc by Dr. C. G. Suits of the General Electric Company attracted considerable attention at Thursday's welding session. Dr. Suits outlined the results of tests in which he calculated the temperature in the core of electric arcs from the observed sound velocity in the arc. Temperatures were shown to be in the range from about 5,000 to 6,500 deg. absolute, with the temperature of the iron-to-iron welding arc 6,020 deg. absolute.

Dr. Suits also described the results of arc studies in various gases at high pressures which may be summarized in the words of Dr. Suits: "Studies of arcs in various gases at pressures up to 1,200 atmospheres have shown some fundamental facts about the high pressure arc. It is found that since the heat transfer in a gas increases with increase in pressure it is possible to compare arcs in different gases at the pressures at which heat transfer is the same and get similar arc characteristics. Thus the arc in nitrogen at a pressure of about 100 atmospheres has the same characteristics as the arc in hydrogen at 1 atmosphere. This comparison of arcs on the basis of heat transfer appears to be generally true in many cases which have been studied."

In discussing Dr. Suit's paper, Dr. Joseph Slepian (Westinghouse) declared the importance of this new arc principle to be such that it might well be hailed as a new law of the electric arc. He pointed out, however, that before that would be possible, more investigation must be undertaken.



● The pivot man in an industrial plant is the motor brush. If it fails to function properly in easy going or rough heavy going, such as sudden peaks or overloading, your plant is paralyzed. Every minute your machinery is idle it costs dollars and in many cases hundreds of dollars. You cannot afford to buy anything but the finest in motor brushes. Ohio Carbon Brushes are scientifically made, uniform in quality, design and materials, consequently they are absolutely dependable. Large and small industrial plants thruout the entire world have been using Ohio Carbon Brushes for years, which proves their absolute reliability under every conceivable working condition.

THE
OHIO CARBON CO.
12508 BEREA ROAD
CLEVELAND, OHIO

program to conserve the heavy investment in otherwise adequate meters.

Whether we are ready to abandon all volt-ampere designations of meter rating and simply have a domestic, a commercial and a power meter is something F. C. Holtz (Sangamo) is not ready to admit.

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Here F. C. Holtz interjected by letter that the prevailing steel pivot with appropriate lubrication may have no more wear than the alloy pivot described in the paper. To him, osmium, iridium and platinum show great promise as pivot materials. A. J. Allen's comment was that the outdoor meter has intensified the need for a non-corrodable pivot if long, light load accuracy is to be attained. A. R. Rutter (Westinghouse) reminded the audience that the familiar ball type of bearing acts like an infinite number of pivots and, employing rolling action, needs no lubrication to avert wear and minimize friction.

Pumped vs. sealed ignitrons for welding control

Discussion of Packard and Hutching's paper on sealed-off ignitrons for welding control at the electronics session on Wednesday brought out clearly the fact that selection of pumped vacuum or sealed vacuum ignitron tubes for welding control is an economic question influenced by the duty cycle of the welder and its size. R. E. Hellmund (Westinghouse Electric & Manufacturing Company) pointed out that with the sealed ignitron life was limited, while with the pumped ignitron, while more expensive in first cost, life was indefinite. He predicted that within a few years the sizes of welders that should use pumped ignitron tubes and those that should economically use sealed tubes would be well established. W. C. White (General Electric Company) showed that there was no competition between the pumped and sealed ignitron tube and that the choice between them was entirely economic in nature. It was reported in the discussion of this paper that there were 400 to 500 sealed ignitron tubes in service and that little trouble

This photograph was taken in our studio in duplicate of a hook-up in actual use and is one of the heaviest in the U.S.A. Details supplied on request The Brewer-Titchener Corp.

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and few failures had been experienced that had not developed soon after installation and been traced to minor manufacturing faults.

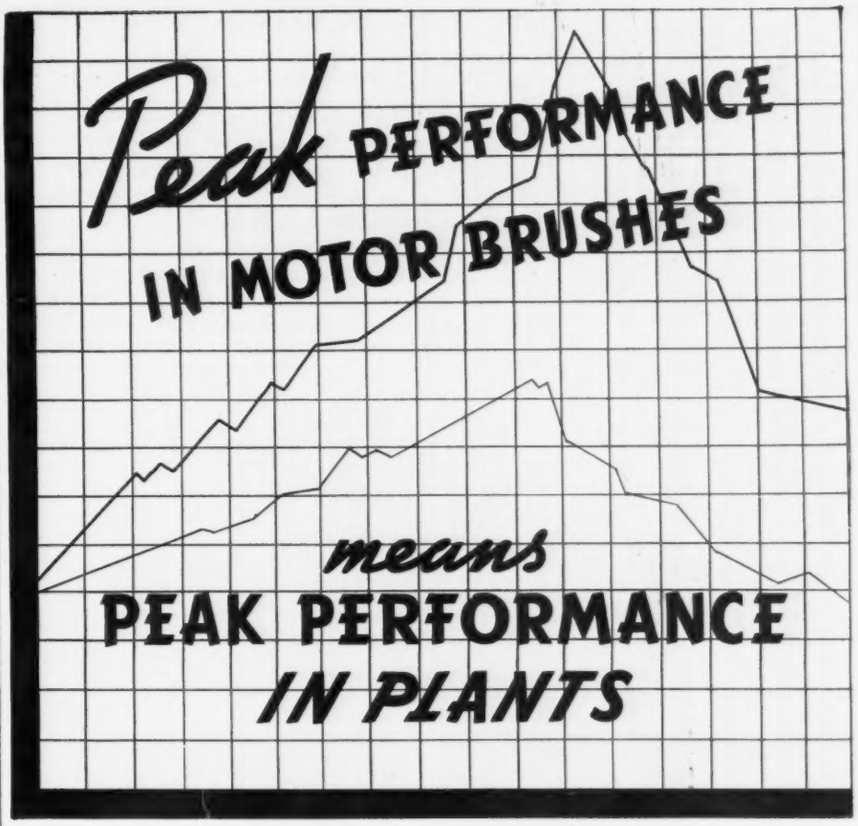
The fact that the electronic regulator for d.c. generators described in F. H. Gulliksen's paper could not as yet be adapted to use on a.c. generators was brought out in discussion by Mr. Ballard of the American Research Council. Gulliksen reported that no tubes are yet available to handle the currents that would be encountered in regulating the a.c. machines. Reply to questions by E. E. George (Tennessee Electric Power Company) indicated that these regulators can be used on d.c. generators operating in parallel without excessive loss of regulation.

New arc theory advanced

An unpublished paper on fundamental phenomena of the electric arc by Dr. C. G. Suits of the General Electric Company attracted considerable attention at Thursday's welding session. Dr. Suits outlined the results of tests in which he calculated the temperature in the core of electric arcs from the observed sound velocity in the arc. Temperatures were shown to be in the range from about 5,000 to 6,500 deg. absolute, with the temperature of the iron-to-iron welding arc 6,020 deg. absolute.

Dr. Suits also described the results of arc studies in various gases at high pressures which may be summarized in the words of Dr. Suits: "Studies of arcs in various gases at pressures up to 1,200 atmospheres have shown some fundamental facts about the high pressure arc. It is found that since the heat transfer in a gas increases with increase in pressure it is possible to compare arcs in different gases at the pressures at which heat transfer is the same and get similar arc characteristics. Thus the arc in nitrogen at a pressure of about 100 atmospheres has the same characteristics as the arc in hydrogen at 1 atmosphere. This comparison of arcs on the basis of heat transfer appears to be generally true in many cases which have been studied."

In discussing Dr. Suit's paper, Dr. Joseph Slepian (Westinghouse) declared the importance of this new arc principle to be such that it might well be hailed as a new law of the electric arc. He pointed out, however, that before that would be possible, more investigation must be undertaken.



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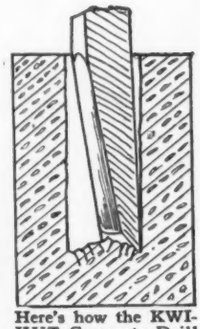
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[*Continued from page 58*]

vate utilities. Morris Cooke recently circulated privately a memo to this general effect, one statement in which was that fifteen years ago Dr. Morgan, in charge of construction of the Miami Conservancy District dams above Dayton, Ohio, caused a bronze plate to be put on the Miami dam to the effect that this dam must never be used for the production of power.

"Did you do this?" the writer asked Dr. Morgan.

"Yes, and I would like to put a somewhat similar tablet on Norris Dam," he replied. "You cannot count on the same storage space for both power and flood control. In that case we surveyed the situation carefully and found that we needed all the capacity we could afford for flood control. To have provided for power also would have cost millions more. Moreover, we estimated the value of crops in the land that would be flooded and found that the value of the power we could expect would be less than the value of the crops which could be raised on that land.

"On Norris Dam I would like to put a tablet that the use of power shall go thus far and no farther. Some enthusiastic power zealots are apt to spoil the whole thing by overdoing the power objective."

•

Municipal Plants

WEST MEMPHIS, ARK.—Chancellor J. F. Guatney held in a recent hearing that the city was entitled to the services of a special master to assist in arriving at a price for sale of the plant of the West Memphis Power & Light Company to the city. Suit brought by the city alleged that the utility agreed at the time it erected its plant to sell it to the city for "a reasonable price" at any time within 30 years after that date. The city recently offered to buy the plant, the suit alleged, but the power company refused to enter into dealings for the sale.

HUNTINGTON, IND.—Last week the state Supreme Court upheld the injunction issued in Huntington Circuit Court forbidding Mayor C. W. H. Bangs from extending the Huntington street lighting utility into the commercial lighting field. Mayor Bangs refused to obey the original order and appealed to the Supreme Court, but failed to post bond and was remanded to jail last July, where he has since remained pending determination of various appeals. The Northern Indiana Power Company obtained the injunction shortly after Mayor Bangs took office. Using the city's street lighting plant as the nucleus of a new utility in competition with the power company which owns the electric utility at Huntington, and

disregarding a temporary restraining order, Mayor Bangs solicited the business of Huntington citizens and connected about 700 customers to the city lighting plant.

FOREST CITY, IOWA—Interstate Power Company's franchise was defeated recently by a majority of 158 votes, with a total of 1,259 votes cast. The city had voted in favor of erecting a municipal light plant at a former election, and this second vote was in response to the utility's application for a franchise to operate another twenty years. The city has not made arrangements as yet for financing the proposed plant.

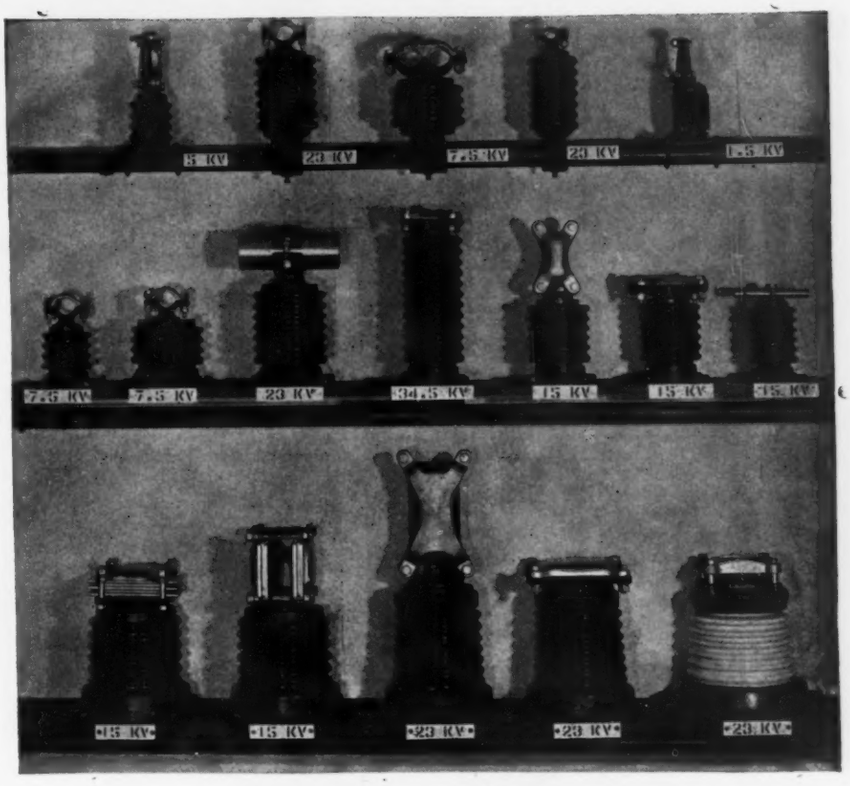
SOMERSET, KY.—City Council has decided unanimously to begin an immediate investigation of plans to establish a municipal power plant. The action was prompted by the belief that rates charged by the Kentucky Utilities Company are too high, the Council stated. A committee was instructed to make a report on the subject as soon as possible. Recently, with the permission of the state Public Service Commission, the utility discontinued the 5 per cent discount on bills paid promptly. The Councilmen said that this discount is stipulated in the franchise grant and the Council was not asked or even informed that the abolition was considered.

DOWAGIAC, MICH.—A temporary order restraining the P.W.A. from disbursing a $202,000 loan and grant to the city for the construction of a municipal power plant and distribution system has been granted by the U. S. District Court for the District of Columbia. The order was requested by the Michigan Gas & Electric Company, which contended that its $250,000 investment in the city would be jeopardized by the proposed plant.

TRENTON, MO.—Plans of the city to build a municipal light and power plant were halted temporarily when a federal injunction was recently granted by Judge Merrill E. Otis. His ruling was made in a memorandum opinion on the injunction application by the Missouri Public Service Corporation. Judge Otis upheld two contentions raised in the application. He held that the Trenton authorities had failed to comply with two Missouri statutes in connection with their advertising for bids for the municipal plant. The memorandum opinion held that the contracts for construction of the municipal plant were not legally awarded. Judge Otis did not pass upon the contention of the plaintiff corporation that it holds an exclusive franchise to furnish light and power to the city. A hearing will be held on the question of issuance of a permanent injunction at a later date, the court announced.

FLOYDADA, TEX.—An issue of $120,000 revenue bonds which were voted last May for the construction of a municipal electric light and power plant, have been ordered sold by the city Council. As soon as proceeds from the sale of these bonds are received, construction of the plant will be started.

PORT CLINTON, OHIO—Voters at a special election rejected by a vote of 963 to 558 a proposal to erect a $250,000 municipal electric plant with W.P.A. aid. Power is now supplied by Ohio Public Service Company, a Cities Service subsidiary, whose contract expired last August. City Council ordered the election be held on the claim that reduced rates offered by the company still were too high.



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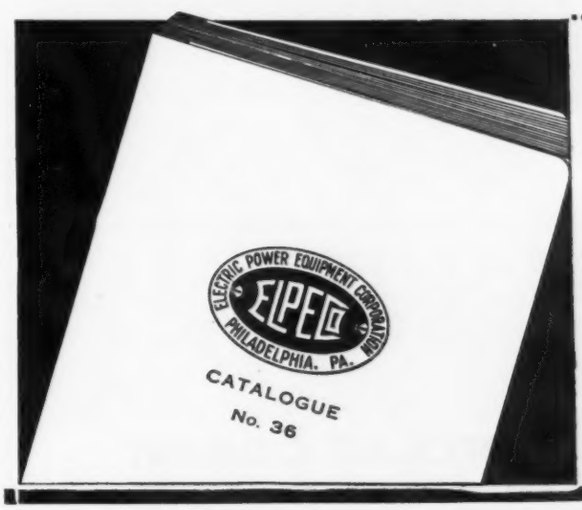

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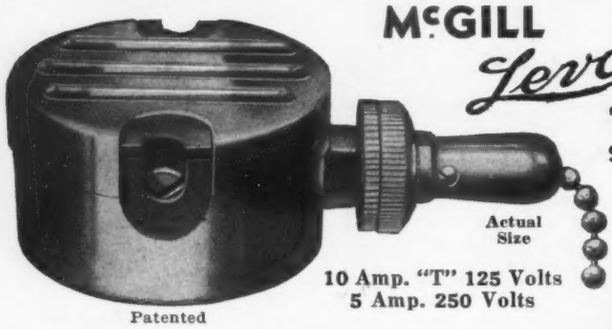

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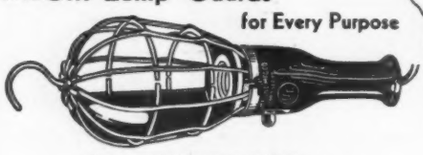

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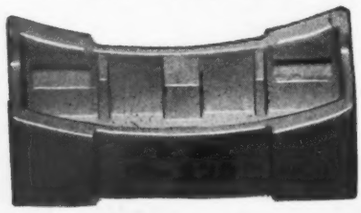

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Thermolain is a porous porcelain of good mechanical strength—an excellent refractory for ranges, heaters, irons, rheostats, immersion heaters, etc., where rapid changes of temperature occur.

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A dense, heat-resistant insulation—recommended for bushings, coils, rods, and other parts requiring mechanical strength and for ovens, toasters and other equipment where high dielectric strength at high temperatures is necessary.

STAR PORCELAIN COMPANY
TRENTON, N. J.

Recent Rate Changes

POTOMAC ELECTRIC POWER COMPANY's bills rendered February 1 were reduced to an extent calculated to effect a saving of $504,021 during 1937 to its customers, under orders issued by the Public Utilities Commission of the District of Columbia. The rate cuts are divided nearly equally between domestic and commercial consumers. Of the total cut the commission allotted $255,702 to the domestic consumers, which will mean a reduction of approximately 20 cents a month. Small industrial and commercial users in Schedule D were allotted cuts amounting to $217,791. Those commercial consumers using Schedule E were granted cuts expected to produce a saving of $21,530.

DUQUESNE LIGHT COMPANY has presented a proposal to the Pennsylvania Public Service Commission to effect a rate cut amounting to $500,000 a year to domestic consumers in the Pittsburgh district. A previous offer of a reduction affecting only commercial and industrial meters was rejected.

PACIFIC GAS & ELECTRIC COMPANY's new rate schedules, effecting a saving of $3,000,000 a year to consumers, has been approved by the California Railroad Commission.

SOUTHWESTERN GAS & ELECTRIC COMPANY has been directed by the Arkansas Corporation Commission to put into effect a sliding scale of rates that will divide between the company and its customers any earnings over and above 6 per cent on a valuation of the company's property at $590,000. However, there will be no immediate reduction in rates because the income in excess of 6 per cent return is so small at this time that it is considered impracticable to make an adjustment of rate schedules.

CENTRAL MAINE POWER COMPANY has filed a new schedule of rates for its residential and commercial customers with the state Public Utilities Commission which reduces the top step of its rates from 10 cents to 8 cents and which will effect a total saving to its residential and commercial customers of $232,570 annually. These new rates become effective on bills rendered after March 15, 1937. Officials stated that territories now having a 10-cent top rate will receive the most substantial savings.

CENTRAL HUDSON GAS & ELECTRIC CORPORATION has filed schedules of reduced electric rates with the New York Public Service Commission which are estimated to save consumers a total of $201,800 annually. Reductions are made in the residential, commercial, general power and brickyard power rates. In the new rate for residential and religious service charges are reduced for all consumption above 35 kw.-hr. per month. The saving is estimated at $112,600. The all-purpose general commercial rates are changed to save consumers $47,500 annually. Changes in the general power rate will save consumers $33,100 a year.

INDIANA SERVICE CORPORATION, heralding an era of co-operation between it and the Municipal Light and Power Works at Fort Wayne, in regard to rate policies, jointly with the municipal plant, petitioned the state Public Service Commission for a reduction in their respective optional residential, light and cooking rates. The proposed new rates will, it is estimated, effect saving of from 50 to 60 cents a month for those customers who now have in service for cooking an electric range of at least 5,000-watt capacity. It is believed that this saving will apply to approximately 70 per cent of the electric range users in Fort Wayne and the immediate vicinity.

Ground Relaying Economical

[*Continued from page 47*]

but, due to time allowances for other relays, the overload settings are necessarily so high that the degree of protection afforded is unsatisfactory. It is also true that the sensitivity of the transformer differential protection is impaired due to the necessity for allowances for magnetizing transients.

This relay arrangement provides a very sensitive and selective relay arrangement which will clear faults on the low-tension portion of the generating station equipment in a minimum of time. It is economical because the current transformers for metering purposes may be used for operation of the relays without additional volt-ampere burden, inasmuch as the relays load the transformers only during fault conditions.

•

Platte Plan Affects Interstate Commerce

Announcement has been made by the Federal Power Commission that the water power and irrigation project proposed by the Platte Valley Public Power and Irrigation District to be constructed on the North Platte, South Platte and Platte Rivers near the town of North Platte, Neb., would affect the interests of interstate commerce.

On the original application the commission found that such interests would not be affected by the project as proposed, but material changes in the plans for the project since that time resulted in the recent finding.

"The effect of the commission's action," Chairman McNinch stated, "will be to bring this project under the commission's jurisdiction and to require the district to secure a license from the commission before constructing the project."

•

Export of Energy Approved

Federal Power Commission has approved the application of the New York State Electric & Gas Corporation for permission to transmit less than 1,000,000 kw.-hr. of electric energy annually from the State of New York to the Canadian Customs and other customers at Franklin Center in Huntington County, Quebec, Canada. The energy is to be sold by the company at scheduled tariff rates.

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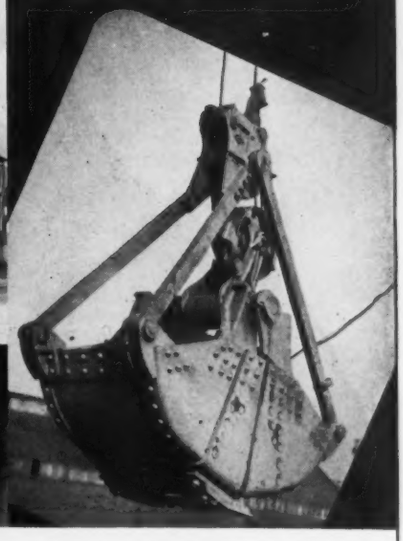
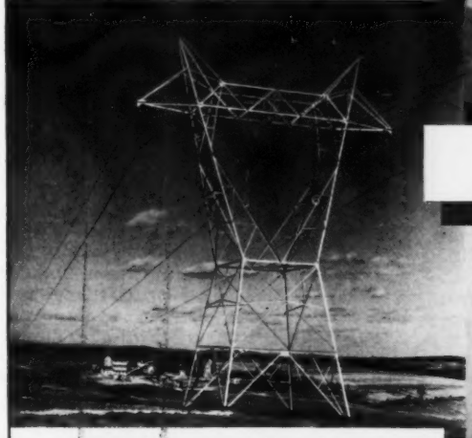


CLAMSHELL BUCKETS



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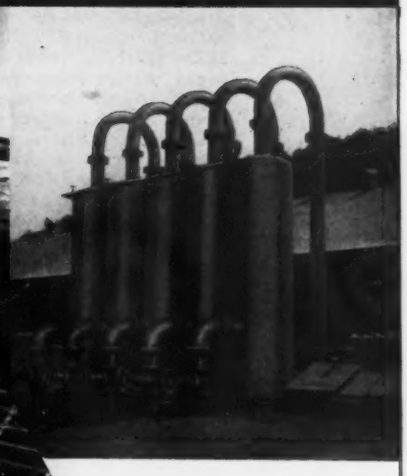
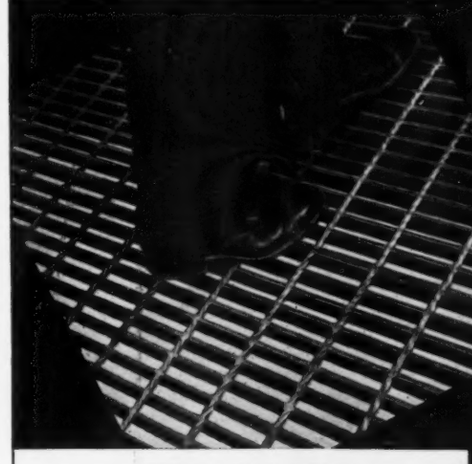


GAS CLEANERS



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Good workmen demand good tools. In the hands of men who know — everywhere — the pliers are invariably Kleins. Only the keen, hand-honed, perfectly matched cutting knives of Klein Pliers — only the comfortable spring grip in the Klein handles — only the general all around quality that is an inherent part of every Klein Plier can satisfy men whose work demands the best in tools. This, perhaps, explains why Klein Pliers are the standard of quality by which others are judged — why the name Klein has stood for maximum quality, "since 1857."

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Sales Opportunities

BALTIMORE, MD.—Consolidated Gas, Electric Light & Power Company has plans for new power substation, 46x130 feet, at 5200 Newgate Avenue. Cost reported over $100,000, with equipment and line connections.

CLAY CENTER, NEB.—Clay County Rural Public Power District, care of C. A. Sorenson, Barkley Building, Lincoln, Neb., attorney and representative, plans primary and secondary lines for rural electrification in parts of Clay County, totaling about 400 miles, with outdoor power substation and consumer service facilities. Fund of approximately $475,000 is being arranged through Federal aid. O. R. Toman, Barkley Building, Lincoln, is consulting engineer.

EVERETT, WASH.—Soundview Pulp Company, Bayside, plans installation of transformers and accessories, motors and controls, regulators, electric hoists, conveyors and other equipment in third unit of local sulphite pulp mills for which bids will be asked soon on general contract. Work is nearing completion on second unit. New expansion will cost about $1,300,000. Company is arranging financing to total close to $1,500,000, to provide for project. Leo S. Burdon is general manager.

OCEANPORT, N. J.—Utilities Office, Quartermaster Depot, United States Army, Fort Monmouth, Oceanport, receives bids until March 1, for two distribution transformers, two distribution panelboards, lightning arresters, 12 indoor bus support assemblies, surface cabinets for cut-outs, cable racks, connectors and other equipment (Proposal 728-19).

WAYNESBORO, GA.—Planter Power Company, P. W. Carswell, president, receives bids until February 17 for transmission and distribution lines for rural electrification in parts of Burke, Jenkins and Screven Counties, comprising about 90 miles of 6900-volt, single-phase primary lines and 15 miles of 115/230-volt two and three-wire secondary lines, with line hardware, fittings and accessories. Also, under separate contract, for 346 watthour meters. J. B. McCrary Engineering Corporation, Atlanta, Ga., is consulting engineer.

GRAND FORKS, N. D.—Northern States Power Company, Minneapolis, Minn., plans extensions and improvements in steam-electric generating station at Grand Forks, including installation of new boilers and accessories, 4000-hp. electric generator unit and auxiliary equipment. Work will be carried out in connection with 1937 expansion program.

MEMPHIS, TENN.—Lehon Company, South Oakley Avenue and West Forty-fourth Street, Chicago, Ill., plans installation of motors and controls, regulators, electric hoists and conveyors in new branch asphalt roofing manufacturing plant at North Memphis, where tract of land has been acquired. Cost about $175,000. A. G. Leonard is president.

NORFOLK, VA.—Bureau of Supplies and Accounts, Navy Department, Washington, D. C., receives bids until February 19 for two diesel engine-generating sets and spare parts, for Norfolk Navy Yard (Schedule 9957).

STORM LAKE, IOWA—Buena Vista County Rural Electric Co-operative, Inc., recently organized, is completing plans and surveys for primary and secondary lines for rural electrification in parts of Buena Vista County, totaling about 315 miles, with outdoor power substation and service facilities. Fund of $100,000 has been secured through Federal aid for first section of project, additional financing to be arranged later for remainder of installation.

ANNAPOLIS, MD.—Bureau of Yards and Docks, Navy Department, Washington, D. C., receives bids (no closing date stated) for extensions and improvements in electric system at Naval Academy, Annapolis, including primary feeder lines, secondary feeders, transformer station, switchboards, distribution panels, branch circuits, lighting fixtures and accessory equipment (Specifications 8381).

DUBUQUE, IOWA—Eastern Iowa Electric Company, Dubuque, plans extensions in transmission lines in parts Dubuque County. Application for permission has been made.

SEATTLE, WASH.—Has rejected bids received recently for 300-foot power dam in Ruby Basin district for hydroelectric power project, and will have revised plans drawn at once for dam 625 feet high, instead of 300 feet, as originally projected. New bids will be asked soon. Proposed municipal generating station will have ultimate capacity of 400,000-hp. Installation will include transmission line to city limits, power substations and switching stations and other structures. Cost close to $5,000,000.

NEWCASTLE, VA. — Craig - Botetourt Electric Association, Newcastle, recently organized, plans primary and secondary lines for rural electrification in parts of Botetourt and Craig Counties, totaling about 140 miles, with outdoor substation and service facilities for approximately 500 consumers. Fund of $180,000 has been secured through Federal aid. Bids will be asked soon.

BROOKLYN, N. Y. — Williamsburgh Power Plant Corporation, 385 Flatbush Avenue, a subsidiary of Brooklyn-Manhattan Transit Corporation, same address, has taken out a permit for proposed seven-story addition to steam-electric generating plant at 492-518 Kent Avenue, 100x140 feet, including operating department and office facilities. Station capacity will be increased by 37,500-kw., with installation of two 18,750-kw. turbo-generators, two high-pressure boiler units and complete auxiliary equipment. Cost estimated at $4,300,000. Stone & Webster Engineering Corporation, Boston and New York, is engineer and contractor.

DALLAS, TEX.—Southland Paper Mills, Inc., Dallas, care of Wirt Davis, chairman of board, Republic National Bank, Republic Bank Building, Dallas, now being organized by Mr. Davis and associates, plans installation of transformers and accessories, motors and controls, regulators, electric hoists, conveyors and other equipment in new pulp and newsprint mill on site now being selected in East Texas, comprising several large units to be equipped for initial output of about 150 tons daily. A power house and electric-operated pumping station will be built. Entire project will cost about $5,000,000. Arthur Temple, president, Temple Lumber Company, Texarkana, Tex., is interested in project.

SAN DIEGO, CALIF.—San Diego Consolidated Gas & Electric Company has plans for one-story addition to steam department at local generating plant at 707 West Broadway, 100x110 feet. Cost over $150,000 with boiler units and other equipment.

That Old Test Meter Is Losing Money for You

[*Continued from page 55*]

tailed by using the old type of rotating standard can be calculated as follows:

No. of meters (adjusted) slow during eight cold months	= 1,000
Total energy metered per year (12×60×1,000)	= 720,000 kw.-hr.
Under-registration of meters, annually, due to cold rotating standard	= 4,500 kw.-hr.

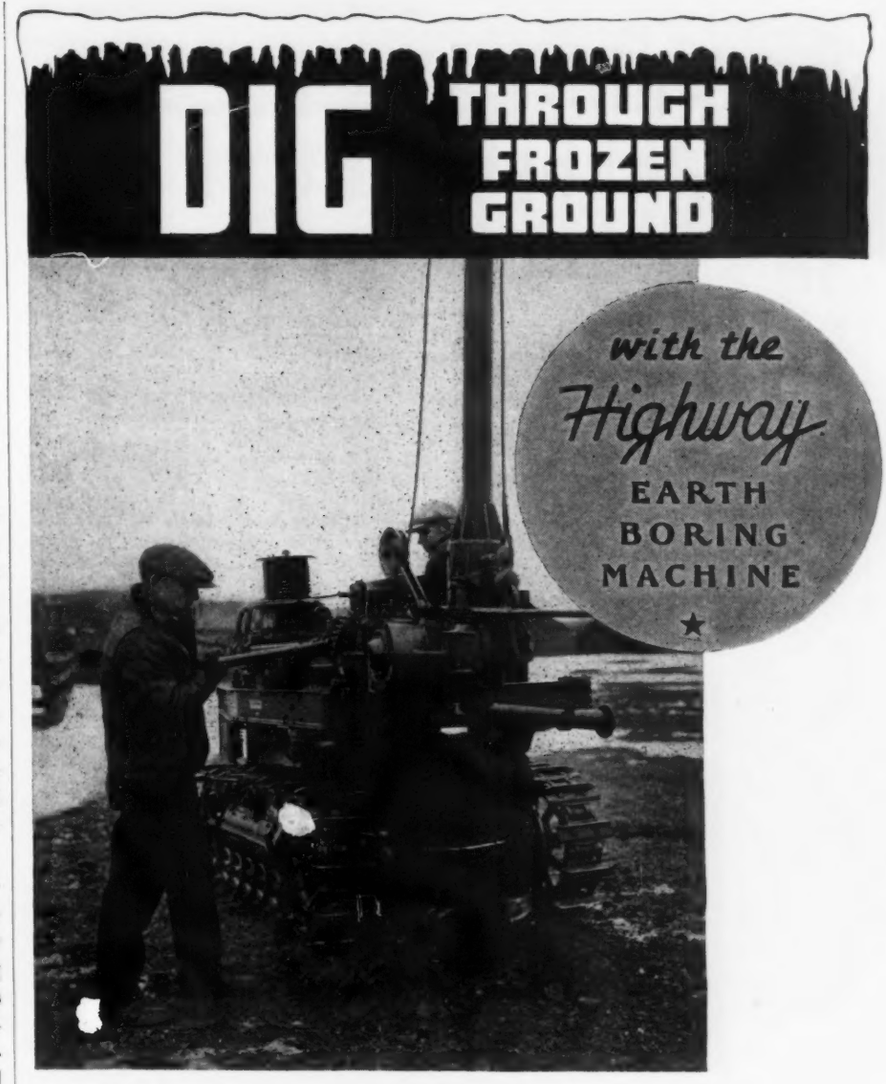
If this practice goes on for four or five years, during the test period, there will be 4,000 or 5,000 slow meters, causing an annual low registration of 18,000 or 22,500 kw.-hr. At 3 cents per kw.-hr. this represents an annual loss of $540 to $675, as the result of the continued use of only one old type of rotating standard which is not temperature compensated. Even if only one new type meter were tested daily with an uncompensated rotating standard, the revenue loss would be one-fifth of the figures given, or from $108 to $125 annually, a figure large enough to buy a new rotating standard annually.

It is worth noting that if new compensated service meters installed outside are to be tested in cool weather with old uncompensated rotating standards, the errors in the standards will be still greater, because the standards will be colder than the temperatures estimated. It should be mentioned also that if the estimated rotating standard temperatures are too low by as much as one-sixth of the difference between outside temperature and 70 deg. F. (the assumed indoor temperature), the average error for eight months will be about two-thirds of 0.625 per cent or, roughly, 0.4 per cent. This would still be much more than sufficient to justify replacements of the old uncompensated rotating standards. If the standard meters were indoors for intervals twice as long as outside during normal use, the error of 0.4 per cent would apply.

•

Dam Opposition Withdrawn

Alabama Power Company has withdrawn opposition to the application of William Gray Meharg of Anniston, Ala., pending before the Federal Power Commission for permission to build a power plant on the Coosa River in Calhoun and St. Clair Counties, Alabama.



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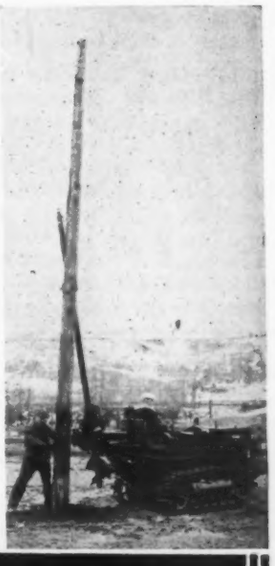

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Do you realize that every foot of combustible wiring in your plant is a potential fire hazard and could be the cause of just such a news item as pictured above? When a short circuit occurs in inflammable wiring the arc ignites the insulation and the flame tends to travel along the wire—and who can say that the resulting damage will not run into headline figures?

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BOOK REVIEWS

Electron Tubes in Industry

By Keith Henney. Published By McGraw-Hill Book Company, 330 West 42d Street, New York, N. Y. 339 pages, illustrated. Price, $5.

Progress in tubes and in their application has justified a revised edition after only two years since the first. Alterations and additions and the effort to make the material more logically arranged and accessible resulted in complete resetting. The new form still lays the foundation for functional performance of electron tubes in the initial chapters and then proceeds to a multiplicity of applications of all types in case-treatment fashion. The book is thus an improved guide to the industrial engineer and designer who wants to know how to connect tubes with what in order to accomplish a given purpose better than by cumbersome mechanical or other electrical means.

•

Connecting and Testing Direct-Current Machines

By F. A. Annett and A. C. Roe. Published by McGraw-Hill Book Company, 330 West 42d Street, New York, N. Y. 302 pages, illustrated. Price, $3.

After eleven years, a revised edition of this book appears justifiable, largely because of the progress in machine insulation. Six new chapters have been added to introduce the results and application of the new N.E.M.A. classification of armatures and field coils on the basis of insulation There is another new chapter on rewinding for increased rating made possible by more efficient insulations. Part I, in addition, retains all its practicality in explaining why and how to rewind machines for different speed or voltage. Part II has three new chapters on testing technique to locate flaws in field and armature. Both sections are amply illustrated with helpful diagrams and also indexed.

•

Electric Power Development in the U.S.S.R.

By a group of authors. Published by Inra Publishing Society, Moscow. (Available through Bookniga, 255 Fifth Avenue, New York.) 496 pages, illustrated.

Evolution of the Soviet power system is portrayed in this book, written in a connected fashion in lieu of a multiplicity of contributions to the World Power Conference. It is packed not only with the statistical facts of the Russian program, but also with the economic justification for both steam and hydro projects. They figure their "heat and power" stations saved a million tons of coal merely in 1934. They show much higher plant factor than attained elsewhere (4,650 hours or 53.1 per cent in 1935). Their regional stations in that year used 17,850 B.t.u. per kilowatt-hour, against our (ELECTRICAL WORLD) figure of 19,260. They turned out more than 4,000,000,000 kw.-hr. from peat-burning plants in 1935 and as many more from stations using anthracite culm, so their technology should be of interest.

Designs are completed for a Leningrad station at 1,850 lb. with ordinary water circulation, and it is said the country is ready for industrial application of extra-high-pressure steam. There is also reported a station design in which boilers and turbines are housed in separate buildings, the bridge passing through the coal-pulverizing plant. The objective is freedom to use any system of removing flue ash and sulphur, good natural lighting and convenience in erection, in repair, in arrangement of water and steam piping.

Part II analyzes the prospects of future developments on fundamental considerations and embraces an exposition of the "Modelization" theory of system development. Structure and location are then discussed for both hydro and steam as well as the economy of high-voltage networks. No other country assembled a more comprehensive and connected presentation of its power philosophy and technique for the World Power Conference.

•

Electrical Laboratory Experiments

By B. C. Dennison. John Wiley & Sons, Inc., New York. Illustrated, 487 pages. Price, $4.

This laboratory test is an abridgment of the well-known "Experimental Electrical Engineering," by V. Karapetoff. It is arranged in the same general style, with both theory and experimental work mingled to give a balanced treatment. It is abridged to give a comprehensive laboratory textbook for engineering students and covers fundamental machines and experiments. A worthwhile book for many courses that do not go into the time and detail involved in a complete experimental textbook.

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Connecting Induction Motors

By A. M. Dudley. Published by McGraw-Hill Book Company, 330 West 42d Street, New York. 464 pages, illustrated. Price, $3.50.

This is a redrafted (Third) edition of a book popular not only with those who have to repair or readapt induction motors but those who want to know the whys and wherefores. The functioning and basic design factors are established in simple language and the types of winding (stator and rotor) are classified and described. Chording and distribution factor, change of voltage, speed and number of phases and poles are all discussed and related to the winding connections in characteristic diagrams preparatory to the reconnection of old windings for new conditions. Fault location, computation of new winding for old cores follow, and then come the well-known 82 standard group diagrams for two to fourteen poles. Chapters on wave diagrams and performance calculation (wholly new) close the book, the latter constituting a method of predicting behavior from existing dimensions of a motor and the new winding contemplated for it.

•

Why Quit Our Own

By George N. Peek with Samuel Crowther. Published by D. Van Nostrand Company, Inc., 250 Fourth Avenue, New York City. 353 pages. Price, $0.50.

Electricity is never mentioned here, but nevertheless there is in these pages a portrayal of the manner in which those who were imbued with the idea that "relief work should be pushed forward with the intent of driving the whole country on relief and thus making the capitalistic system commit suicide" undoubtedly pulled the Punch and Judy strings to put over the Wheeler-Rayburn bill and kindred measures. Actually, the

book is the author's dirge of disappointment at the wrecking of the wholesome farm-recovery plan which he had already conceived when he accepted the A.A.A. appointment. The Frankfurters, Franks, Tugwells and Morgenthaus are on every page, even of the diary entries following jousts with the inner circle.

Peek also shows here how, over 38 years, we have made the rest of the world a present of $22,000,000,000 by our choice of farm and export policies.

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The Language of Economics and Ethics

By Robert S. Hale. Published by Bruce Humphries, Inc., 306 Stuart Street, Boston, Mass. 154 pages. Price, $2.

Revealing his interest in utility economics, the author soliloquizes about some 75 terms that dominate the vocabulary of modern socio-economics. More rigor in terminology is an implied objective, but the text itself does not present definitions that conform to lexicon standards. Rather does Mr. Hale hope to reform usage by revealing looseness in terminology.

Somewhat startling is the theorem that ultimate original cost is inevitably zero and faithful reproduction cost is infinite. Less provocative but more stimulating is the proposal that economic disputes could better be settled by research and engineering consultants than by dashing to a court, or regulatory commission, or bureaucracy or dictator.

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Flow Meter Engineering Handbook

By Gess & Feldmark. The Brown Instrument Company, Wayne & Roberts Avenues, Philadelphia, Pa. 162 pages, illustrated. Price, $2.

Seven of the eight sections are devoted to the tabular and analytical foundation for the technique of flow measurement. Orifice coefficients are first developed and then the factors for steam flow, along with the pressure and temperature indexes; the piping diagrams for flow metering are provided here as well as in the succeeding sections on water flow, other liquid flow, air and gas flow. Final sections deal with pipe and orifice data and pressure losses. Thus the book serves a previously unfilled want for data basic to competent application of flow metering. The significance of the compiled data is embraced in the solution of several typical problems.

•

Electronics and Electron Tubes

By E. D. McArthur. John Wiley & Sons, Inc., New York. 173 pages, illustrated. Price, $2.50.

Electron tubes are rapidly invading a wide field of application in addition to radio. This book gives the fundamental data on all tubes, their theory of operation, their connections and descriptions of typical applications. It is not a detailed mathematical treatise and is written to give the essential conceptions and theory. It sticks to fundamentals, but has tabular data to make the theory tangible. It includes consideration of electrons, gases, elements of tubes, types of tubes, control of tubes, special tubes, gas or vapor tubes, construction of tubes and tube applications. A valuable element is the bibliography accompanying each chapter. This book should find ready acceptance in colleges as well as to students in the new field.

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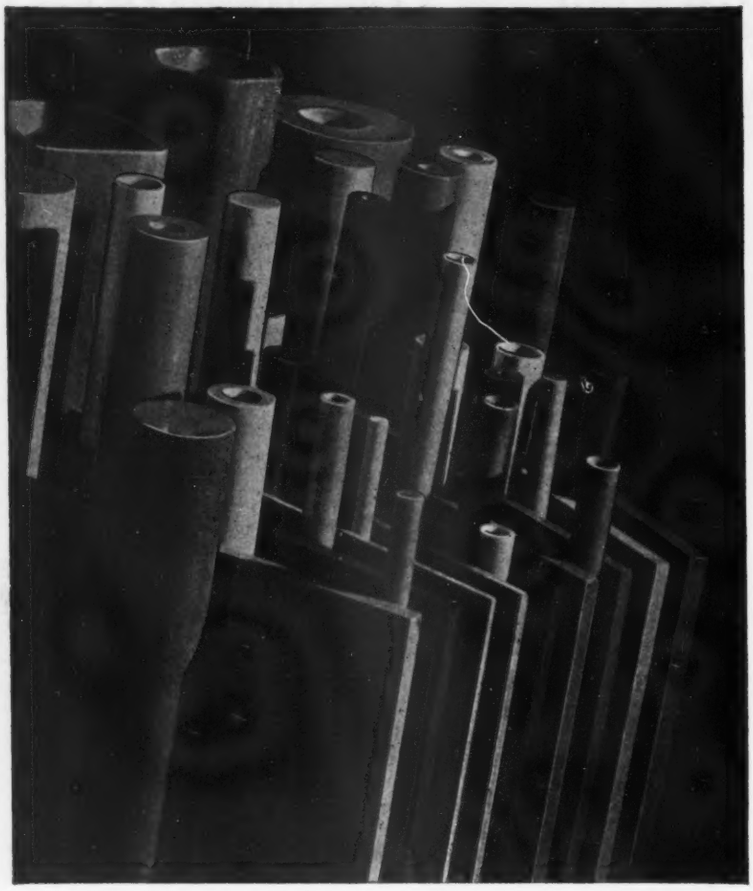

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TORONTO — MONTREAL

R. E. A. Allots Funds; New Loan Contracts

A loan contract for $290,000 for building 275 miles of rural electric lines in Tennessee has been executed, the Rural Electrification Administration recently announced. Allotments totaling $590,000 for construction of rural electric lines in Iowa, North Dakota and West Virginia have also been announced. R.E.A. was also advised that construction contracts have been awarded for projects in Indiana and Kentucky.

Loan contracts

TENNESSEE—Madison: The Southwest Tennessee Electric Membership Corporation of Brownsville may use up to $290,000 to build 275 miles of rural lines to serve 1085 customers. The lines will serve parts of Madison, Haywood and Tipton Counties.

Allotments

IOWA—Buena Vista: The Buena Vista County Rural Electric Co-operative of Storm Lake received an allotment of $100,000 to begin construction on a rural line project. The proposed project will consist of about 317 miles of lines to serve some 886 customers in Buena Vista County. The annual cash income in the county is nearly $4,000 per farm.

IOWA—Hardin: An allotment of $100,000 has been made for a co-operative now being organized in Hardin County. This allotment will begin construction on some 250 miles of lines to serve 600 customers. Current for the project will be supplied from one of the generating plants to be financed by R.E.A. funds and announced several weeks ago in Iowa.

NORTH DAKOTA—Cass: The Southern Cass County Electric Co-operative of Kindred received an allotment of $220,000. This project will include some 241 miles of lines to serve over 700 farms and rural customers in Cass, Richland and Barnes Counties.

WEST VIRGINIA—Hampshire: An allotment of $170,000 has been made for a co-operative now being organized in Hampshire and Mineral Counties. The proposed project will include some 170 miles of lines to serve 650 customers.

Construction contracts

KENTUCKY—Jefferson: A contract to build about 35 miles of rural lines, sponsored by the Kentucky Rural Electrification Company, of Louisville has been awarded to the Monroe Electric Company of Chicago, Ill. Based on unit assemblies, the contract will total $47,218.07 for the extension of lines through parts of Fleming, Lewis and Mason Counties.

INDIANA—Johnson: A contract to build about 276 miles of rural lines, sponsored by the Johnson County Rural Electric Membership Corporation, of Franklin has been awarded to the Ulen Contracting Company, Lebanon, Ind. Based on unit assemblies, the contract will total $244,796.94 for the extension of lines through parts of Johnson, Morgan, Bartholomew, Marion and Shelby Counties.